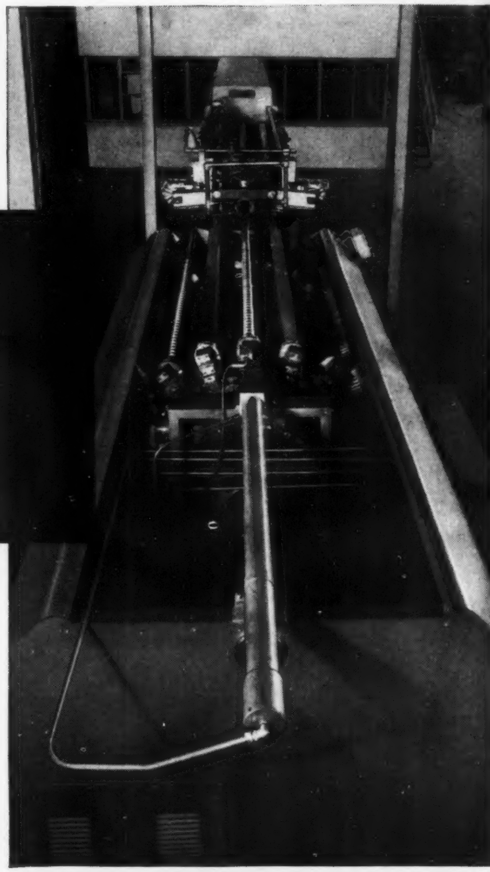
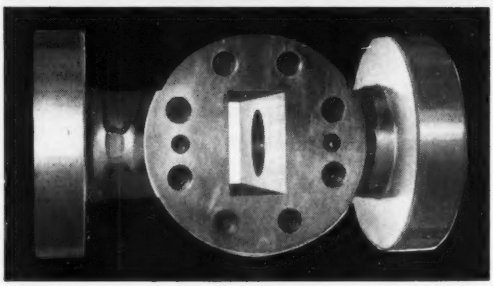
MACHINERY

AUGUST 23, 1961 ONE SHILLING & THREEPENCE

to 1 on this Lapointe machine



It's 'odds on' that whatever your broaching requirement, a Lapointe machine exists or can be adapted to do the job for you—better, faster.
This HP 100 x 100 horizontal broaching machine, for example, broaches rectangular holes $5\frac{1}{2}$" wide x $2\frac{3}{8}$" thick x 12" long from a hole $2\frac{1}{16}$" diameter.
The operation used to take 40 hours; now, using a 14 broach set-up designed to make it automatic from start to finish, production time has been cut to less than one hour!



Gate Valve Body, weight 300 lb.
By courtesy of Cameron Iron Works, Leeds.

Lapointe collaboration begins at the design stage.
For problems like this, and others, it pays to—

come to LAPOINTE for better broaching

British made **The Lapointe Machine Tool Co. Ltd**
Otterspool Watford By-Pass Watford Herts
Watford 31711 (4 lines) Cables: Lapointe Watford
Subsidiary: Lennie & Thorn Limited Bracknell Berkshire
also The Lapointe Machine Tool Company Hudson Mass. USA

When answering advertisements kindly mention MACHINERY.

"The Mountains of Eternal Light"

The most imposing and massive of all the mountain ranges on the moon are the Leibniz Mountains which spread their mighty bulk right over the Moon's South Pole for 600 miles, whilst many of the peaks are well over 30,000 feet high.

These peaks have been well described as "the mountains of eternal light."

This little inset shows you how to find them with a strong pair of binoculars. The best time is when the Moon is a crescent in the Western sky. So lofty are these mountains that it is possible to see the peaks twinkling like stars in the darkened portion.

In this representation we show them as they would look in an eclipse when the Earth comes between the Moon and the Sun and the mountains take on a copper hue.

The great scientific programme announced for the Moon's conquest must be firmly based on a broad and progressive technology. That technology will be sure to include Balfour's Capital High Speed Steel Twist Drills, Cutters, Reamers and other Engineers' Tools as an essential ingredient to success.

STEEL & TOOLS **ARTHUR BALFOUR** FOR THE WORLD

ARTHUR BALFOUR & CO LTD. CAPITAL STEEL WORKS, SHEFFIELD ENGLAND.
ASSOCIATED COMPANY: THE EAGLE & GLOBE STEEL CO, LTD.

See us at STAND NO. 3212 HALL NO. 3,
7th EUROPEAN MACHINE TOOL EXHIBITION, BRUSSELS from SEPT; 3rd - 12th.


For any job—
WOOD, METAL, PLASTIC ETC.
it cuts through the lot
ECLIPSE No 66 GP FOR GENERAL PURPOSE SAWING
Here's a saw which will cut both wood AND metal — one saw for all the odd jobs about the house, the farm, the garden, the building site and so on. If the "odd job" is the cutting of hard wood, soft wood, wood in which nails or bolts are embedded, hard rubber, plastics, fibreboard, the everyday range of pipes and bars made from mild steel, copper, brass, aluminium, lead and the like, here's the saw that will cut through the lot! The blade can be adjusted for sawing in almost any position.
HANDLE ADJUSTABLE TO NINE DIFFERENT SAWING POSITIONS
* Price
15/6
Eclipse
general purpose saw
Made by James Neill & Co. (Sheffield) Ltd., and obtainable from hardware and tool dealers

S SA. 12

Lubricated for LIFE!

The NEW sleeve-bearing drip-proof motor

. . . for light industrial applications and domestic appliances . . .

★ $\frac{1}{4}$ h.p. and $\frac{1}{8}$ h.p. single phase, split phase. Voltages: 100/110, 200/220, 230/250. 50 cycles or 60 cycles.

★ Designed to meet the new British Draft Washing Machine Specification, NEMA — MG1 and European Specifications.

★ Class E insulation to B.S.1844 and B.S.2757.

★ Tested to B.S.170.

★ Sleeve bearings are capable of operation in any position and are lubricated for life.

★ Ventilation design is of exceptionally high efficiency.

Send for Publication FHP/139 to The ENGLISH ELECTRIC Co. Ltd., F.H.P. Motors Department, Phœnix Works, Bradford.

'ENGLISH ELECTRIC'

f.h.p. motors

THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2.

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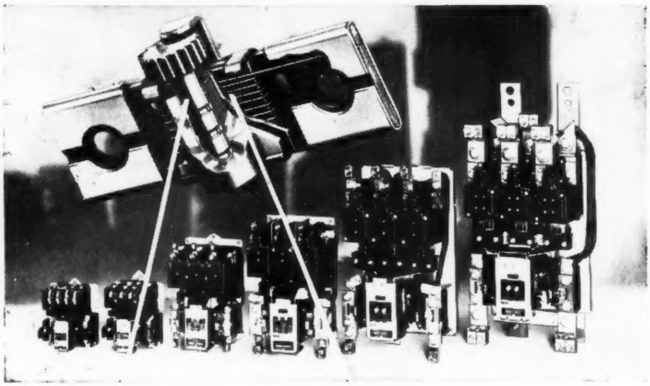
WORKS: STAFFORD PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

FHP.43A

When you buy Motor Starters - -

YOU PAY FOR OVERLOAD PROTECTION

BE SURE YOU GET IT!



Heat-responsive element *(solder pot) provides accurate response to overload, yet prevents nuisance tripping.*

Heat producing element *is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.*

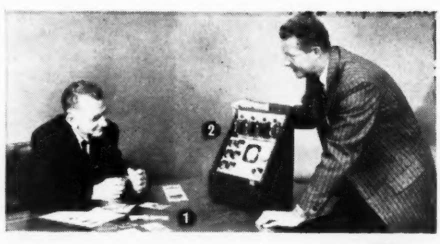
Only ONE-PIECE Overload Relays can give 100% Protection. Only with ONE-PIECE construction can you *know* you've installed the heater correctly. Only with ONE-PIECE construction can you *know* the heater is exactly centred, or properly positioned, so that it performs according to its rating. Only with ONE-PIECE construction can you *know* your starters will not operate without the thermal units properly installed. Only with ONE-PIECE construction can you *know* your motors have full protection.

Only Square D has ONE-PIECE Construction. ONE-PIECE construction eliminates any possibility of heater misalignment. Square D melting alloy thermal overload relays can be installed only one way. They are tamper-proof. They are factory-assembled, are individually calibrated and tested. Repeated tripping will not affect their accuracy.

Insist on square D starters with melting alloy thermal overload relays

LET US PROVE IT!

Let your Square D Field Engineer show you **1** how one-piece construction is accomplished and how easy it is to mismatch separate heaters and solder pots — **2** a tripping time tester to compare various types of melting alloy units and to prove that tripping time won't change after repeated operation.



LEADERS IN CONTROL GEAR FOR OVER 50 YEARS.

To have the best *Specify* Square D

SQUARE D LIMITED

CHENEY MANOR SWINDON WILTSHIRE

Square D products are stocked by leading electrical wholesalers throughout Great Britain.

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1961

Tapershank performance... Jobber's cost

Clarkson TaperFast System

For you TaperFast means an immediate reduction in your drilling expenditure. For every size of Jobber Drill you use from $\frac{1}{8}$in.—$\frac{1}{2}$in., A—Z or 1—31, you can now use a Tapershank Drill, but it will cost you no more than you are now paying for your Jobbers. This means that you can have Tapershank performance at Jobber's price.

If you want to know more about this new advance in drilling technique, all you have to do is to write or phone your nearest Clarkson Service Centre.

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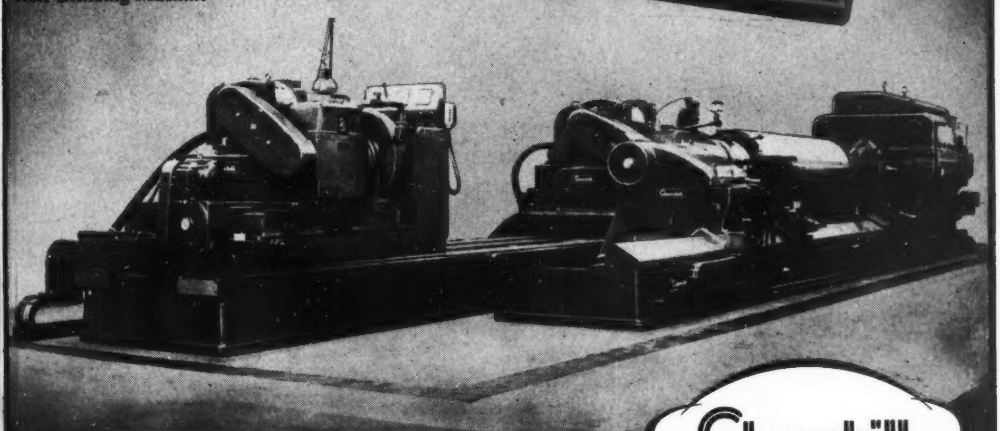
Precision Grinding Machines

Model "BW" Automatic Plain Grinding Machine

Model "TWR" 72in. x 360in. Heavy Duty Roll Grinding Machine



Churchill

PRECISION PLUS PRODUCTION

THE CHURCHILL MACHINE TOOL CO. LTD.

BROADHEATH **MANCHESTER**

HOME SELLING AGENTS
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BRUSSELS EXHIBITION—Churchill 'BW' Plain and 'HBM' Internal Fully Automatic Grinding Machines will be shown on Stand 2007 at the 7th European Machine Tool Exhibition, September 3rd-12th, 1961.

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HOT ROLLED STEEL STRIP

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The Finest, Most Versatile, 14" Screen Contour Projector Available.
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A Precision Measuring, Bench Model Projector for All-Round Use.
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CONTOUR PROJECTORS* FIT YOUR OPTICAL GAUGING REQUIREMENTS
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A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity
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with Plain Table for Production-Line Use with Chart-Gauges and Fixtures.
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Write for new edition of EX-CELL-O Contour Projector Booklet—Available Now!
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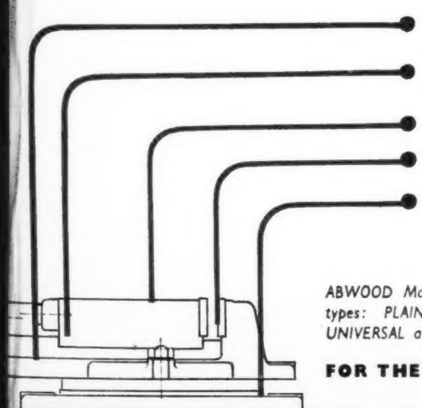
THE VICE

with all the virtues

THE TOOLROOM & PRODUCTION NO TRAPS FOR SWARF, LOW HEIGHT WITH RIGIDITY



V SLIDES ADJUSTABLE FOR WEAR. LONG BEARING SURFACES. IMPOSSIBLE FOR THE JAW TO LIFT AND TILT THE JOB.

TOTALLY ENCLOSED SCREW WHICH CANNOT BECOME SEIZED OR BRUISED.

SLIDING JAW MACHINED OVER ITS WHOLE SURFACE FOR THE USE OF THE SCRIBING BLOCK.

GROUND TOOL STEEL JAWS AND PHOSPHOR BRONZE NUT

ACCURATELY MACHINE DIVIDED SWIVEL BASES INDEXED FULLY THROUGH 360 .

ABWOOD Machine Vices are available in the following types: PLAIN, SWIVEL TYPE (illustrated), SHAPER, UNIVERSAL and UNIVERSAL COMPOUND ANGLE TABLES.

FOR THE TOOLROOM & PRODUCTION

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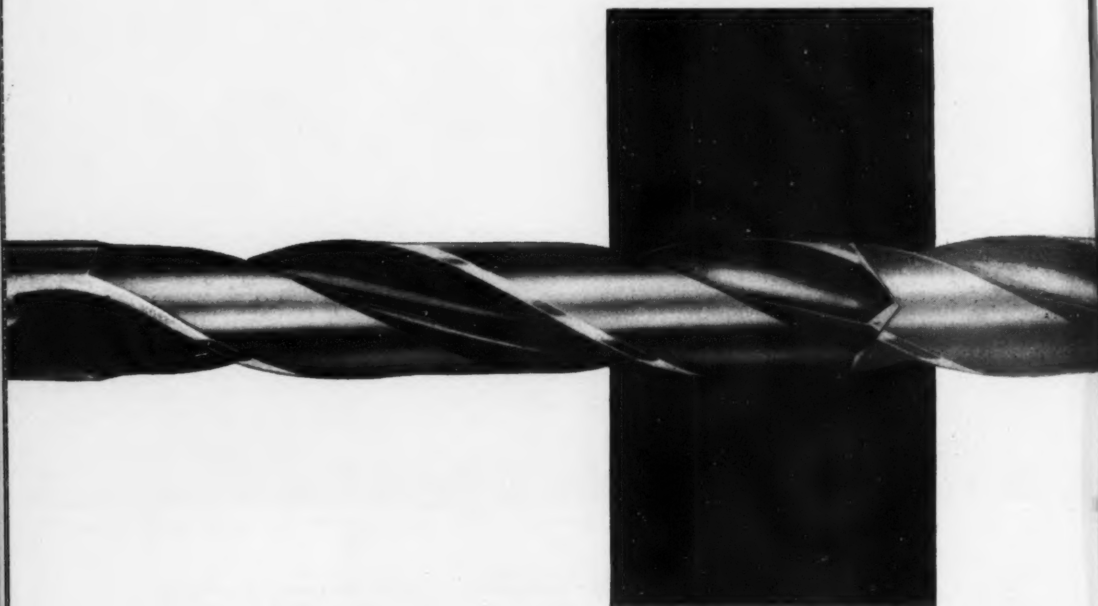
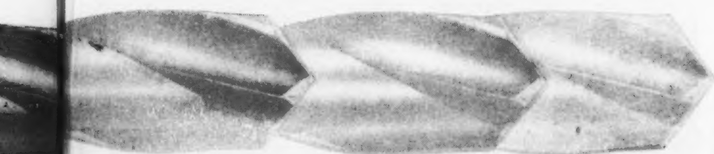
ABWOOD MACHINE TOOLS LIMITED

THE SHORTEST DISTANCE



$\frac{31}{32}$" dia. SPEEDICUT "CHIPBREAKER" Drill on black steel plate 2" thick at a speed of 110 ft. per minute with ·020" feed. Previously the best conditions were, speed 80/90ft. feed ·010"—the "Chipbreaker" drill has reduced drilling time by half.



600 *See these at*

7th EUROPEAN MACHINE

BRUSSELS, SEPT.

We draw your attention to the special features

HILGERS MASCHINEN-UND APPARATE BAUANSTALT M.B.H., GERMANY
HALL No. 8, STAND No. 8203
Exhibits include:

Model HY.38 Electric-hydraulic Semi-automatic Tube Cold Bending Machine, for tubes up to 38mm. o.d. with 2mm. wall thickness = approx. $1\frac{1}{2}$" o.d. with ·08" wall thickness. In new design fitted with automatic hydraulic slide rail pressure device.

Model HDY.114.BD Electric Hydraulic, Semi-Automatic Tube Bending Machine in special design, equipped with automatic, hydraulic booster device synchronised to the running of the machine model HDY.114 on which we will bend tubes 70mm. o.d. with 5mm. wall thickness to a radius 1, 5 × D.

Model HYB.50.GVU Electric-hydraulic Automatic Tube Cold Bending Machine for tubes up to 50mm. o.d. with 2mm. wall thickness = approx. 2" o.d. with ·08" wall thickness. *i.e.* the Automatic Tube Cold Bending Machine fitted with: fully automatic combined positioning and angular turning-device, but *without* feeding device.

KOLLMANN MASCHINENBAU C.M.B.H., GERMANY
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Exhibits include:

Model MBVS.62 Plano Milling Machine, with 2 horizontal milling spindle heads type Ia/130 with I vertical milling spindle head type Ia/130 with a capacity of 18·5 kW each. Working surface of table 126" × $43\frac{1}{4}$". Bed $275\frac{1}{2}$" × $31\frac{1}{2}$". Daylight between the columns $64\frac{11}{64}$". Daylight between the horizontal spindle noses $35\frac{1}{2}$"—$55\frac{1}{8}$". Daylight between table and lower edge vertical spindle nose 0—$55\frac{1}{8}$" with automatic programme control.

A.B. MALCUS HOLMQUIST, SWEDEN
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Exhibits include:

Model MC-50 Centreless Grinder with 50 H.P. main motor, together with the new automatic Bar Feed Table 306. On this machine bars with diameter about $\frac{1}{2}$" and length about 10' are to be ground.

Model MC-50a Centreless Grinder arranged for automatic grinding of twist drills with taper shaft.

Model MC-35a Centreless Grinder.

Model MP-5 Surface Grinding Machine with hydraulic equipment.

Selson MACHINE TOOLS

Sole Agents in the United Kingdom:

The Selson Machine

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TOOL EXHIBITION
3rd to 12th 1961
incorporated in the Machine Tools listed below

J. MODLER, GERMANY
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Exhibits include:

Model MT.75 Special Centreless Production Grinder for special rollers. Model MRK.82 special continuous Production Grinder for the Convex ends of taper rollers. Model MN.78 special end Grinding Machine for bearing needles.
Model MS.79 special Double End Grinding Machine for highest quality requirements. Model MTS.400 special Ballworks Grinding Machine system (Grinding) Model MK.81-400 Ball Filing Grinding and Lapping Machine. Model MKS.89 Special Ball Sorting Machine.

PRAEHOMA-WERK KEHREN & CO., GERMANY
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Exhibits include:

Model RWS Compound Rotary Table Surface Grinding Machine. Table diameter 28″. Model RW.6 Rotary Table Surface Grinding Machine with horizontal grinding spindle. Diameter of table 24″.
Model L.10 Longitudinal Surface Table Grinding Machine. Grinding length 48″. Clamping width 14″. Wheelhead diameter 16″.

R. STUHLMANN & CO., GERMANY
HALL No. 3, STAND No. 3309
Exhibits include:

Model NZ.250.S Internal Keyseating Machine, 10″ stroke. Model NZ.320.S Internal Keyseating Machine, 12″ stroke. Model NZH.100 Hydraulic Internal Keyseating Machines for 20″, 26″ and 31½″ lengths of strokes.

U.V.A., SWEDEN
HALL No. 7, STAND No. 7603
Exhibits include:

Ready to discuss your problems on cold heading and thread rolling. (Machines not being shown).

G. VERNIER, FRANCE
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Exhibits include:

Model FV.3/S Combined Universal Vertical Milling Machine. Model 750 New Type Ramhead Milling Machine. Model 1059 Heavy Duty Ramhead Milling Machine. Model 1160 New Type Fixed Bed Swing-out Universal Head Milling Machine.

VOEST, AUSTRIA
HALL No. 4, STAND No. 4014
Exhibits include:

Automatic Lathes.

We look forward to meeting you. Our Technical Representatives will be present to give you all the information you require.

Tool Company Limited.

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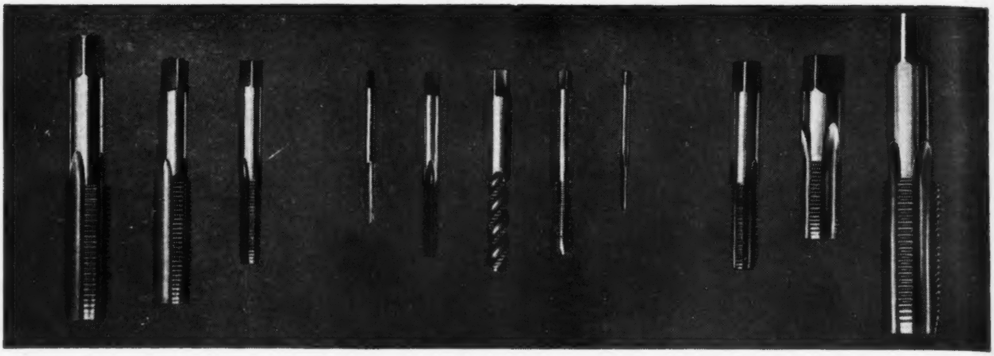
And at Kingsbury (Nr. Tamworth) Manchester, Glasgow, Swansea, Newcastle-on-Tyne, Sheffield, Southampton, Belfast, Bath.



All these tap sizes on one machine

When it's a

MEDDINGS *Pacera*

First class thread from 10BA in any material to $\frac{1}{2}''$ in Mild Steel . . . $\frac{3}{4}''$ in Brass . . . 1″ in Aluminium and Zinc Alloy . . . with a Meddings Pacera Pitch Controlled Tapping Machine. *The* machine for high quality work at *your* price!

The secret?—easily interchangeable lead screws and lead screw nuts, with a specially developed pitch control attachment. No material is 'difficult' for these machines. Even with aluminium or perspex you can be sure of an accurately formed thread. Thin materials? You can tap 10 BA through $\frac{1}{32}''$ material without any trouble at all. The machine comes in a variety of models, and there's a high speed version and a slower version of each. Accurate setting for top and bottom of tapping stroke—with cam-operated micro-switches. More than one hole to tap with the same thread? The machine is ideal for multi-spindle work. Lead screw and nut to your choice supplied with every machine.

Write for full particulars to the makers:

W. J. MEDDINGS LTD

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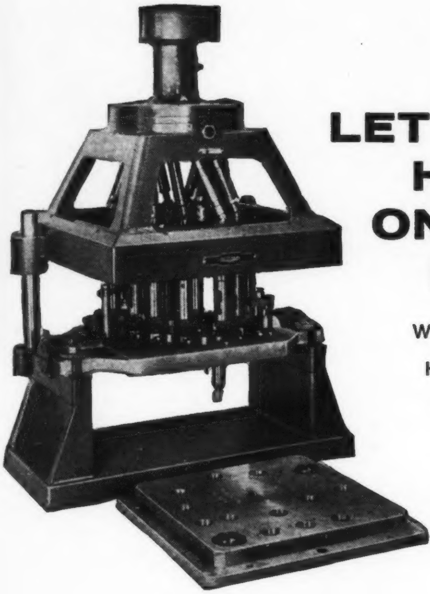
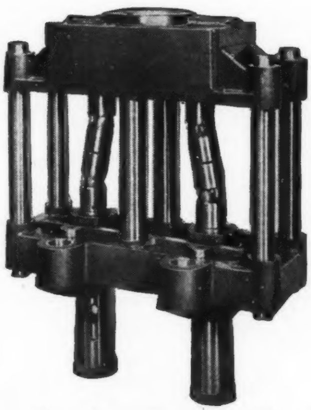
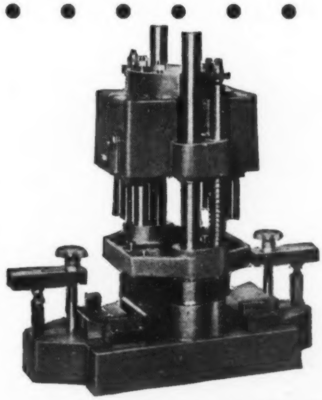


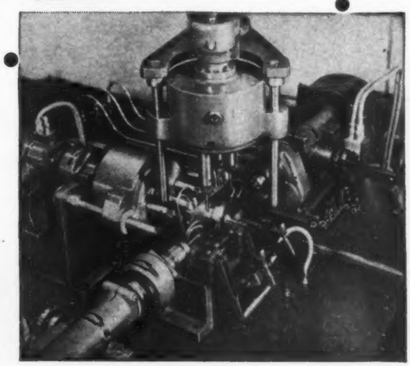
VISIT US ON STAND
6103, HALL 6
7th European Machine Tool Exhibition, Brussels, September 3rd to 12th, 1961

LET'S PUT OUR HEADS TOGETHER ON YOUR DRILLING PROBLEM

We supply precision built multi-spindle drilling and tapping Heads to suit your machine—for light, medium or heavy work and with spindles up to No. 5 M.T. Geared, gearless and adjustable types are available to meet your requirements. Additionally, we can supply complete tooling, fixtures, bushplates etc. for your particular application. We design and build special-purpose machines incorporating multi-spindle Heads to meet your own specific needs.







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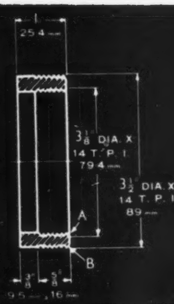
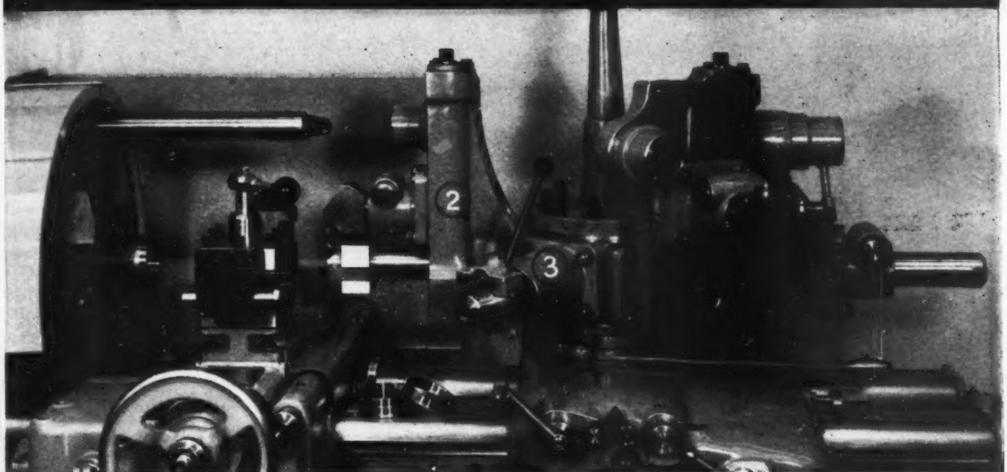
TOOLING LAYOUT No. 15





SCREWED RING

Machined all over.

Floor to Floor Time :

1 min. 45 secs.

No. 7 TURRET LATHE

Code Word : **COVHYRO (SP)**

Special Headstock with Spindle having
$4\frac{5}{8}$" dia. Bore and Fitted with 15" — 3-Jaw Tudor Chuck.

STEEL TUBE

All Tungsten Carbide Cutting Tools.

Note :— Time for cutting external and internal threads simultaneously (7 cuts) 25 seconds.

DESCRIPTION OF OPERATION	Tool position		Spindle Speed R.P.M.	Max. Cutting Speed		Feed	
	Hex. Turret	Cross-slide		Feet per min.	Metres per min.	Cuts per inch	m/m. per rev.
1. Feed tube to stop and close chuck	1	—	—	—	—	—	—
2. Knee turn $3\frac{1}{2}$" dia., bore, face end and chamfer "A" and "B"	2	—	683	627	191	134	·19
3. Back chamfer bore	3	—	683	560	170	Hand	Hand
4. Cut threads $3\frac{1}{2}$" and $3\frac{1}{8}$" dias. × 14 t.p.i. Whit. form, right hand (7 cuts)	—	S.T.1	683	627	191	—	—
5. Part off	—	S.T.2	683	627	191	Hand	Hand

'PRELECTOR' Combination Turret Lathes with Preselective speed-changing.

TURRET LATHES with capacities up to 35 in. swing over bed

$1\frac{1}{4}$ in. to $2\frac{1}{2}$ in. 'D-S' 'DOUBLE-SLIDE' Capstan Lathes for heavier accurate work.

Stock Tools, Toolholders, Chucks and Accessories for Capstan and Turret Lathes.

H. W. WARD & CO LTD

SELLY OAK, BIRMINGHAM 29

'Phone : Selly Oak 1131

BRITISH MACHINE TOOL MAKERS ASSOC. LTD ABMTM

W.688

***BRUSSELS EXHIBITION* — Ward Double-Slide Capstan, Prelector and 10/13 Turret Lathes will be shown on Stand 2102 at the 7th European Machine Tool Exhibition, Brussels, September 3 — 12, 1961**

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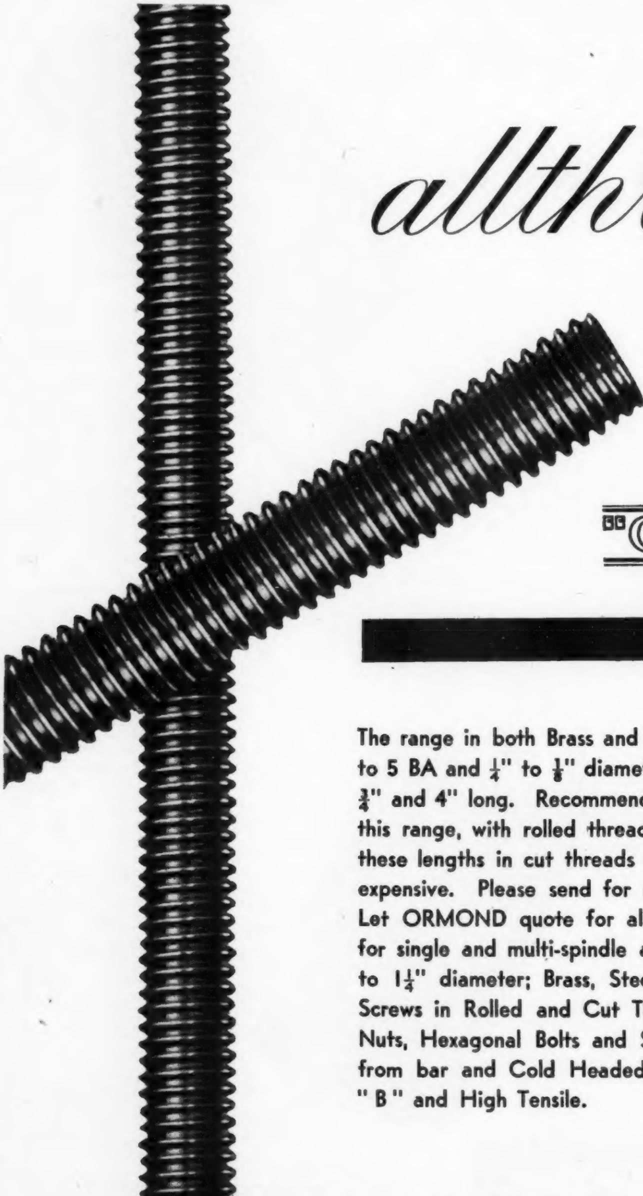


allthreads

ENGINEERING ORMOND COMPANY LTD.

The range in both Brass and Steel is from 0 BA to 5 BA and $\frac{1}{4}$" to $\frac{1}{8}$" diameter and between $\frac{3}{4}$" and 4" long. Recommended for use within this range, with rolled threads, where studding in these lengths in cut threads would be too expensive. Please send for stock lists.
Let ORMOND quote for all Repetition Parts—for single and multi-spindle automatics up to $1\frac{1}{4}$" diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grub-screws, Nuts, Hexagonal Bolts and Set-screws, turned from bar and Cold Headed Grades "A," "B" and High Tensile.

THE ORMOND ENGINEERING CO. LIMITED

Ormond House, Rosebery Avenue, London, E.C.1. Telephone: TERminus 2888. Telegrams: Ormondengi, Cent

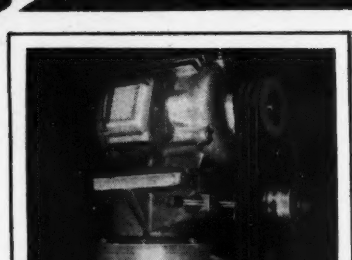
Sanderson's Heliocentric Speed Reducing Gears help "Terylene" production

Dress in "Crimplene" made from 100% Terylene. By Courtesy of I.C.I. Limited.

Sanderson's Heliocentric Speed Reducing Gears have been chosen by Imperial Chemical Industries Limited to play an important part in the production of 'Terylene' polyester fibre. Gears are installed in I.C.I. plants producing 'Terylene' in Great Britain, and in the many plants manufacturing polyester fibre under licence throughout the world.

Heliocentric may be the answer to your power transmission problems—range of ratios 20:1 to 512,000:1. Horse power 1/6 to 30.

Please write for illustrated brochure to Department H.G.



Motorised Heliocentric Speed Reducer, ratio 280:1 designed for synthetic fibre extrusion plant

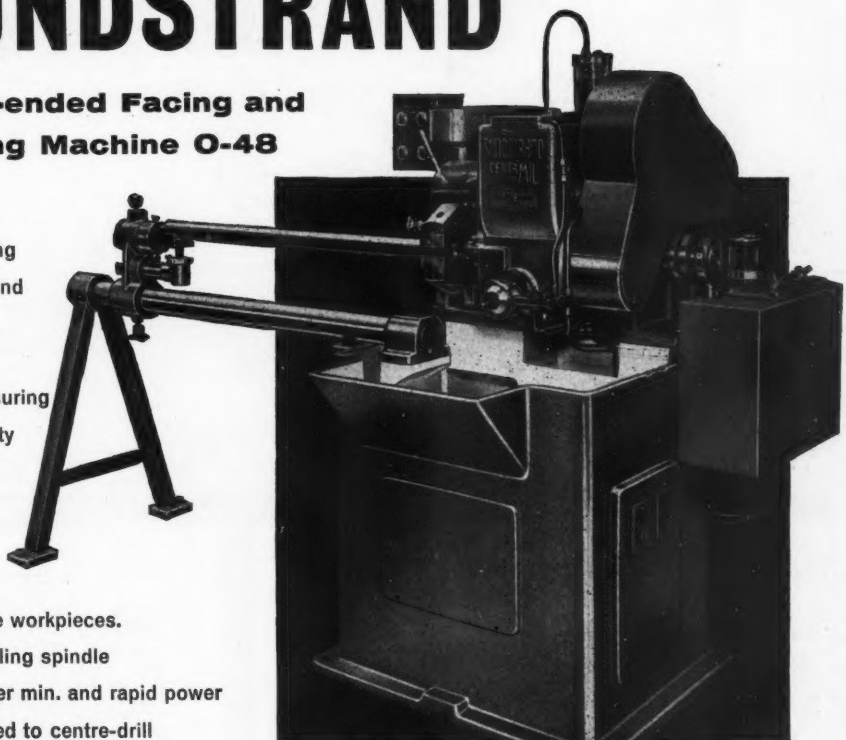
SANDERSON BROTHERS AND NEWBOULD LIMITED

Attercliffe Steelworks, P.O. Box 6, Newhall Road, Sheffield 9

SAVE 60% or more on FACING and CENTRING—

SUNDSTRAND

Single-ended Facing and Centring Machine O-48



Combines centring with milling the end face, cutting out re-chucking and automatically ensuring exact concentricity and squareness. Fast, simple to set, equally economical for batches or single workpieces. Air-hydraulic milling spindle feeds 1" to 18" per min. and rapid power return. Power feed to centre-drill and power clamping. Equipped with outer support and positive turret end-stop.

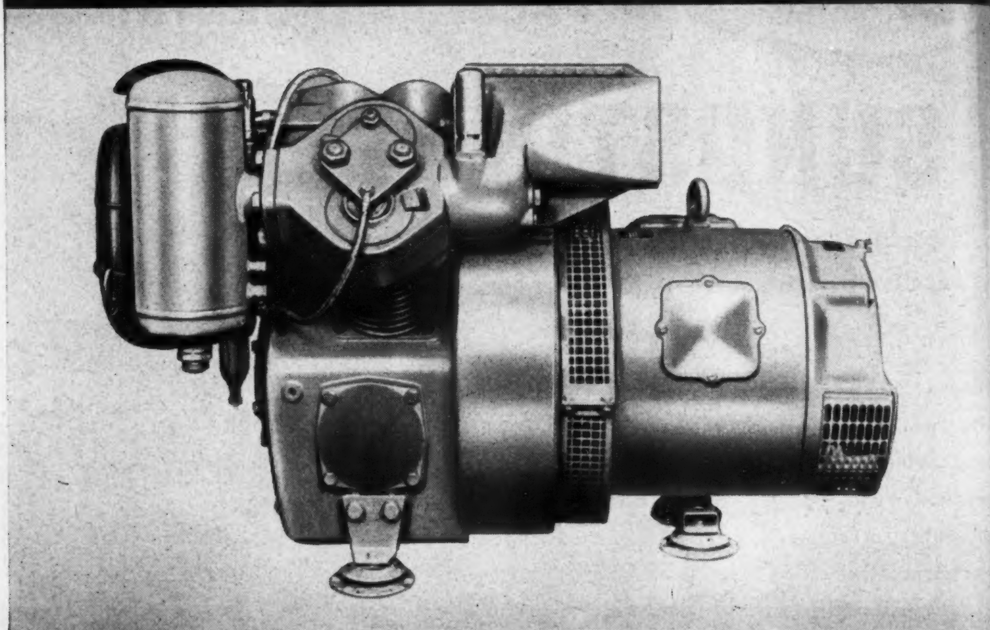
Length of work 5" to 48", diameters $\frac{3}{4}$" to $3\frac{1}{2}$".
Milling cutter dia. 4".
Milling spindle speed 75 r.p.m.
Centre drills up to $\frac{3}{4}$" dia.

See this machine at our Showrooms, or write for the fully illustrated brochure M/226 to the Sole U.K. Distributors:

DOWDING & DOLL LTD
346 KENSINGTON HIGH STREET, LONDON, W.14
Tel: WESTERN 8077 (8 lines) Telex: 23182 Grams: ACCURATOOL LONDON TELEX

226

HERE'S AIR POWER FOR THE MEDIUM SIZED WORKSHOP



THE ATLAS COPCO COMPRESSOR TT6

Developed from the famous VT portable compressors, the Atlas Copco TT6 is a compact, heavy-duty machine for round-the-clock operation where there is a moderate but continuous demand for compressed air.

The compressor is a single-acting, two-stage machine with air-cooled cylinders and intercooler. It is built for a normal working pressure of 100 p.s.i. and has a free air delivery of 141 c.f.m.

NO FOUNDATIONS NEEDED. The TT6 and its electric drive motor are mounted on 'Metalastik' bonded rubber feet. This eliminates the need for foundations as the compressor can be placed directly onto concrete floors. The TT6 can also be moved from place to place as circumstances dictate.

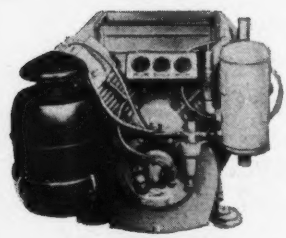
Like the VT portables, the TT6 combines an outstanding power/weight ratio with a basically simple design which ensures reliable service and easy maintenance. The TT6 is a sound investment for medium-sized or small-but-growing companies.

AUTOMATIC CONTROL AVAILABLE. Available as an optional extra, the Atlas Copco Regulator allows the TT6 to be run with standard valve unloading system or as a fully automatic stop-and-start unit.

WRITE FOR THE LEAFLET Atlas Copco leaflet E1207-1 gives full details of the TT6. It is freely available on request from the address shown.

ATLAS COPCO (GREAT BRITAIN) LIMITED
Maylands Avenue, Hemel Hempstead, Herts. Tel: Boxmoor 6040

Sales and Service Depots: LONDON · BRISTOL · CARDIFF · LICHFIELD LEEDS · MANCHESTER · NEWCASTLE · GLASGOW · BELFAST · DUBLIN



1/204

Atlas Copco

puts compressed air to work for the world

V 10 B

Talk to Sykes about the V10B . . .

for racks and segment gears

The V10B Rack cutting model cuts spur or helical racks, up to 24 in. long, in a pre-set Auto-cycle of 1, 2 or 3 cuts. Once set the machine requires no further attention other than loading of the workpiece.
On removal of the rack cutting sub-table the machine reverts to a conventional gear shaper but with the additional facility of cutting segment gears, of any desired angle, in an automatic cycle of one to three cuts. Infinitely variable speeds and feeds. Built-in calculator dials. Switch selected direction of feed. Adjustable rotation controller for segment gear cutting. Auto table reverse. Electro-magnetic feed clutches. Constant hydraulic infeed with micrometer setting. Direct reading saddle indicator. PLUS . . . The availability of the basic V10B range of equipment and accessories.

If you have racks or segment gears on your production programme, write for a copy of brochure P18/60.

7th European Machine Tool Exhibition, Brussels, September 3-12, Stand No. 5111, Hall 5

SYKES

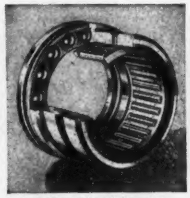
W. E. SYKES LIMITED · STAINES · MIDDLESEX · ENGLAND

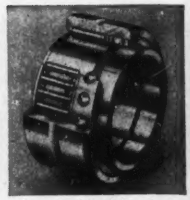
and associated companies:

Sykes Tool Corporation Ltd., Windsor, Ontario, Canada. Sykes Machine & Gear Corporation, Detroit, Michigan, U.S.A. W. E. Sykes Ltd., Mascot, Sydney, NSW, Australia.


Ina Needle Cage

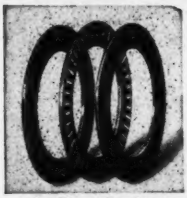

Ina Needle Bearing

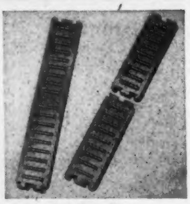

Ina Combined Bearing (NKX Series)

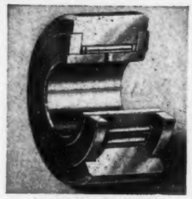

Ina Combined Bearing (NKIB Series)

INA

CAGE GUIDED NEEDLE BEARINGS


Ina Thrust Bearing

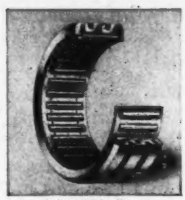

Ina Flat Cage


Ina Roller Follower (NATR Series)


Ina Cam Follower

introduce new principles into engineering

- **Space saving advantages resulting in economic design.**
- **Even load distribution with maximum rigidity of mounting.**
- **High peripheral speeds.**
- **Bearings range from shaft diameters of 4-390 mm.**
- **Over 3,000 types and sizes kept in stock.**


Ina Adjustable Bearing

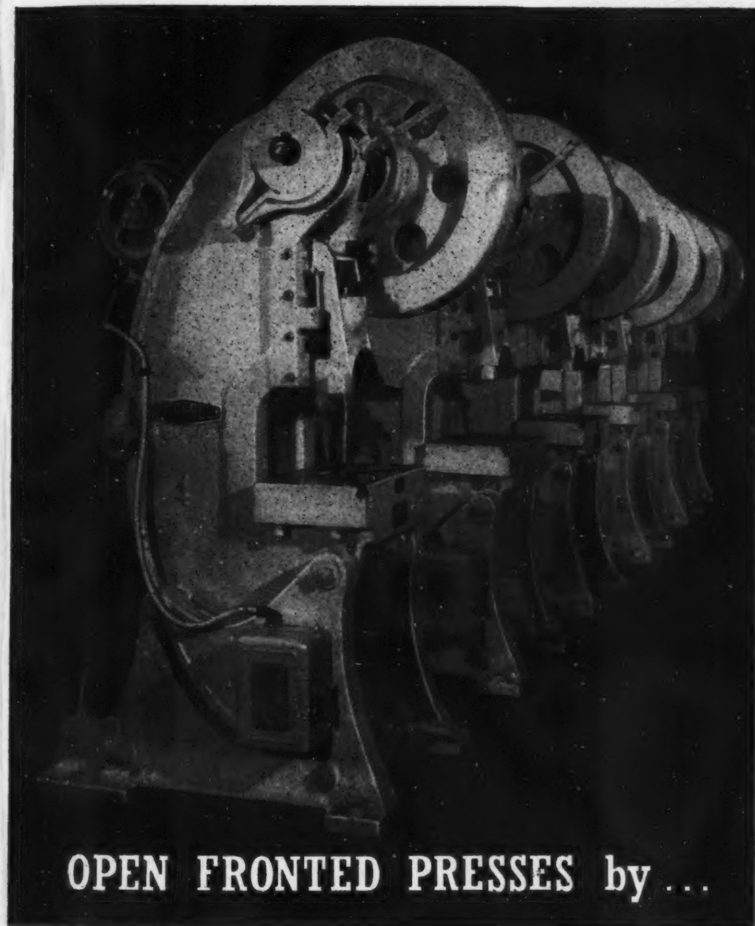

Ina Shell Type Bearing

Our local technical representative is at hand to advise you. Write for your free copy of the Ina Technical Handbook and Comprehensive Catalogue L.301.

INA NEEDLE BEARINGS LTD

Head Office and Factory: Dept. M, Dafen, Llanelly.
Tel: Llanelly 4312/6. Telex: 4816.

Ina Bearings are manufactured in Great Britain, France, Brazil and Western Germany.



BUTTERLEY

The Butterley range of sheet metal machinery includes geared and ungeared power presses, guillotine shears, press brakes and general machinery for the hot and cold working of metals.

All castings are made by the MEEHANITE process in our own well-equipped foundries. The Butterley foundries are available for the production of high-grade MEEHANITE castings to customers' requirements.

We invite your enquiries for MEEHANITE castings of all grades up to 20 tons.

The word MEEHANITE is a registered trade mark.

Full details of Butterley Sheet Metal Machinery supplied on request . . .

THE BUTTERLEY COMPANY LIMITED, RIPLEY, DERBY, ENGLAND. Tel.: RIPLEY 411 (9 lines)

London Office: 9 Upper Belgrave Street, S.W.1. Tel.: SLOane 8172/3

SM20

Diamond Hones

* FULL RANGE OF STANDARD SIZES TO SUIT ALL HONING MACHINES
* SUITABLE FOR TUNGSTEN CARBIDE, FERROUS AND NON-FERROUS MATERIAL, CERAMICS, ETC.
* GEOMETRICAL ACCURACY AND PRECISION ENSURED

For honing the big end bores of connecting rods, Vauxhall Motors Ltd. employ the set-up shown above at their Luton Plant.

Utilising the Diagrit Metal bonded diamond hones, a consistent finish, time cycle and life is obtained. Diagrit diamond hones have been well proven throughout the industry as being thoroughly dependable for rapid metal removal, combined with consistent finishes and precision.

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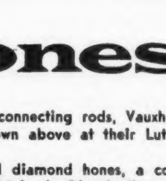
ADDRESS ....

DIAGRIT DIAMOND TOOLS LTD., STATION RD., STAPLEHURST, TONBRIDGE, KENT

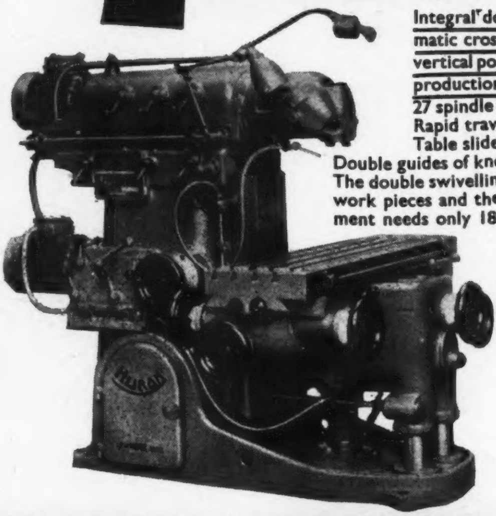


SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



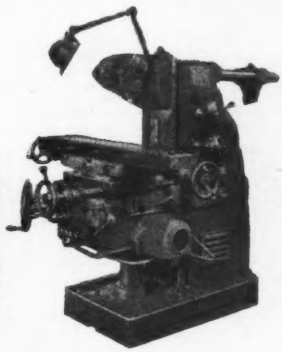
Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1¼ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56$\frac{1}{16}$in. × 15⅜in.	43¼in.	27½in.	19⅝in.
KU5	64$\frac{1}{16}$in. × 15⅜in.	51⅛in.	27½in.	19⅝in.
KU6	78⅜in. × 16½in.	59in.	27½in.	19⅝in.
KU55	64$\frac{1}{16}$in. × 26in.	51⅛in.	38⅝in.	18$\frac{1}{16}$in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.

MODELS 53 & 61. 16 universal head spindle speeds. 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ⅛-18¾in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ⅛-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{1}{16}$-23¾in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43¾in. × 9⅞in.	27½in.	9⅞in.	15⅜in.
61	47¾in. × 10⅞in.	30¾in.	9⅞in.	15⅜in.
59	51$\frac{3}{16}$in. × 11⅞in.	34¼in.	11$\frac{13}{16}$in.	21$\frac{1}{16}$in.
54	67in. × 14⅜in.	43¼in.	14½in.	20⅜in.

EUROPEAN MACHINE TOOL EXHIBITION, BRUSSELS SEPTEMBER 3—12, 1961

We look forward to demonstrating these machines to you on STAND 9119, Hall 9; and STAND 6119, Hall 6

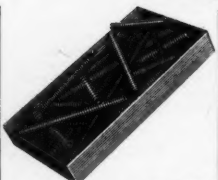
Send for full particulars of our very extensive range of these machines; ask for demonstration

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

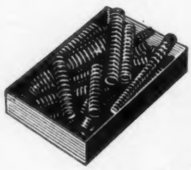
Tel. CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON, W.4.

EXPERIMENTAL SPRINGS?

Don't grope here...

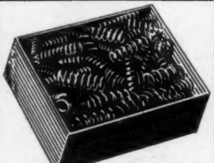


No. 1200
Three dozen Assorted Light Expansion Springs, suitable for carburettor control, etc. 15/-.

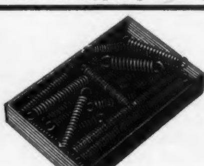


No. 760
Three dozen Assorted Light Compression Springs. 1" to 4" long, 22 to 18 S.W.G., ¼" to ½" diam. 7/6.

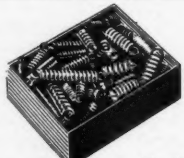
No. 98A
Three dozen Assorted 1" to 4" long, ⅛" to ⅜" diam., 19G to 15G. 6/6.



No. 757
Extra Light Compression, 1 gross Assorted, ⅛" to 7/16" diam., ¼" to 2½" long, 27 to 19 S.W.G. 18/-.



No. 753
Three dozen Assorted Light Expansion ⅛" to ¼" diam., 2" to 6" long, 22 to 18 S.W.G. 12/-.



No. 758
Fine Expansion Springs. 1 gross Assorted ⅛" to ⅜" diam., ¼" to 2" long, 27 to 20 S.W.G. 18/-.

That spring you want . . . in a hurry . . . where is it? Pick what you want, when you want it, from TERRY'S BOXES OF ASSORTED SPRINGS—our fine range of small boxed assortments of experimental springs. We can show you only a few from the range here. Send a postcard for our full list—and if ever you're stuck with a spring problem send it along to our Research Department—they'll gladly help you out.

Have you a Presswork problem?

If so, the help of our Design Staff is yours for the asking.

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for SPRINGS

Really interested in Springs? "Spring Design and Calculations" 10th Edition tells all—post free 12/6.

Cut Production Costs with Terry's Wire CIRCLIPS. We can supply immediately from stock — from ⅛" to ⅝".

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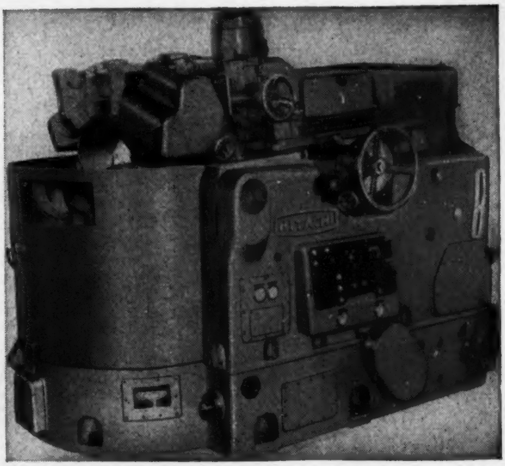
(Makers of Quality Springs, Wireforms and Presswork for over 100 years.)

MT510

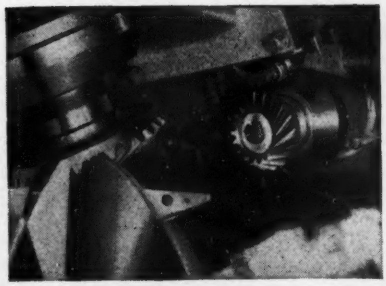
Efficiency *plus*

HITACHI

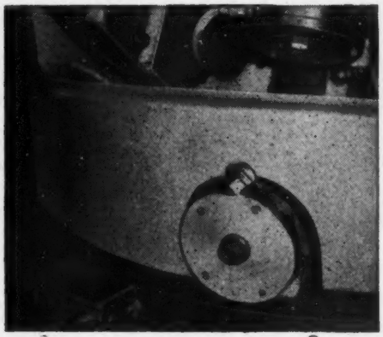
Bevel Gear Grinder



HITACHI Bevel Gear Grinder Type 600 BG-1



WORK HEAD
The photo shows that a set of gear and pinion is fitted on each work head.



DIAL FOR AUTOMATIC SETTING
The table constructed in the two-stage type, and is provided with a screw for parallel slide and a dial.

Characteristics:

The HITACHI bevel gear grinder, Type 600 BG-1, has been designed on an entirely new principle of generating method, and is credited with the following features:—

1. **The machine can be operated with utmost ease.**
2. **Crowning is possible even in the direction of gear teeth.**
3. **The same grinding wheel can be used irrespective of dimensions, helix angles, pressure angles of the bevel gears to be processed.**
4. **Meshing tests can be conducted without removing the processed gear.**

Specifications:

Max. pitch dia.	610 mm.
Min. pitch dia.	50 mm.
Largest cone distance	305 mm.
Pressure angle	14½°—20°
Max. helix angle	35°
Module	2.5M—8M
Dia. of grinding wheel	400 mm.
Main Motor	5 h.p.
Size of Machine	2,765 mm. x 2,000 mm. x 1,850 mm.
Net Weight	approx. 11,00 kg.

Patents on this grinder:—

Patents have been applied for in the United States, Britain, Germany, Switzerland and Italy, in addition to those already taken out in Japan.

Other HITACHI products include:—

Gear hobbing machines
Knee-type milling machines
Surface grinders
Roll lathes and grinders
Railway car wheel lathes
Axle journal returning and burnishing lathes
Transfer machines, etc.

Hitachi, Ltd.
Tokyo Japan
Cable Address: "HITACHI" TOKYO

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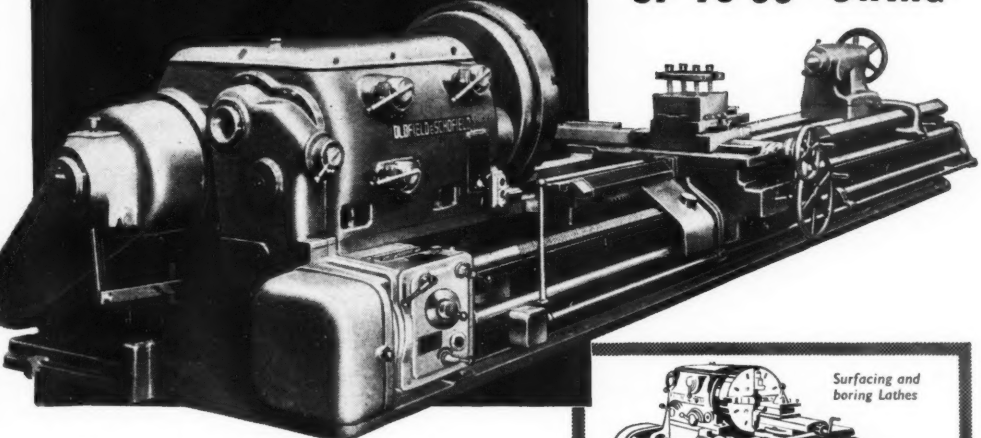
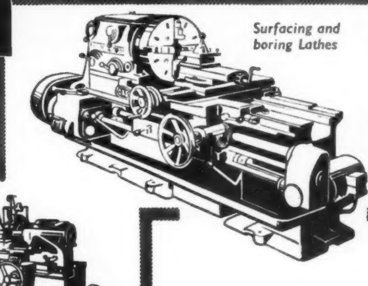
Heavy Duty LATHES

O & S

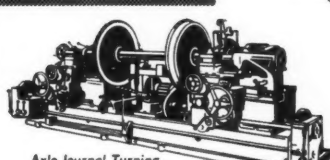
UP TO 96" SWING



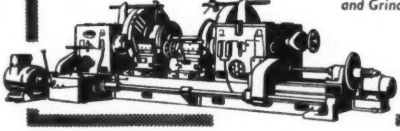
18½" Centre 'D' Type Lathes. Built in sizes up to 48" swing.



Surfacing and boring Lathes



Axle Journal Turning and Grinding Machines



Heavy Duty Double Wheel Lathe

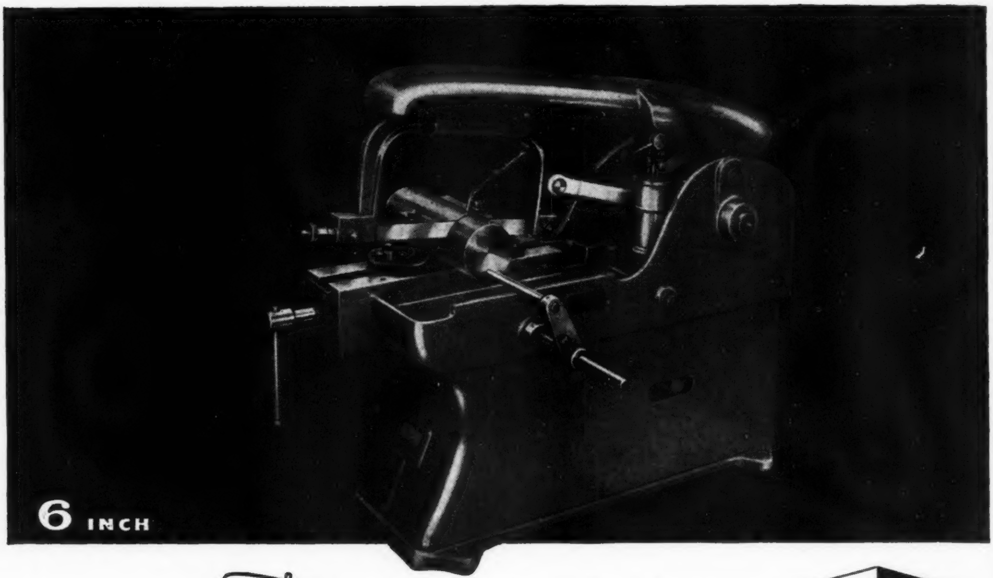
O & S have for many years manufactured a wide variety of heavy lathes which have earned for the company a fine reputation for precision engineering and first class craftsmanship. The range includes Surfacing and Boring Lathes up to 96" swing, Brake Lathes, Axle Lathes, railway carriage and waggon wheel lathes, axle journal turning and burnishing lathes etc., all embodying the latest developments in modern lathe design.

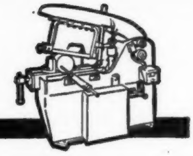
O & S

manufactured within the KERRY GROUP by
OLDFIELD & SCHOFIELD CO. LTD
BOOTHTOWN, HALIFAX, YORKSHIRE

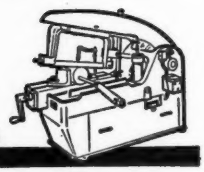
A Kerry COMPANY

Sales Office: WARTON ROAD, STRATFORD, LONDON, E.15. Telephone: MARyland 6611





8 INCH



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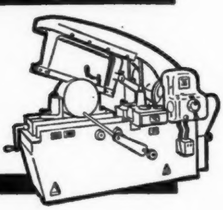

12 INCH

Full details from your machine tool merchant or our Sales Office

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SAWMASTERS

are the finest HEAVY DUTY HACKSAWS in the world

Modern in design, robust and precise in construction, these unrivalled machine saws cut accurately and rapidly, and offer maximum production efficiency. Refinements include totally enclosed drive, hydraulic relief on the return stroke and automatic lifting of the bowslide to loading position on completion of cut.

Instant lever selection of correct cutting speed is a feature of all but the smallest model.

—and the famous SAWMASTER Autocut Power Bandsaw.

Q&S

manufactured within the KERRY GROUP by
QUALTERS & SMITH BROS. LTD
BARNSLEY, YORKSHIRE

A Kerry COMPANY

Sales Office: WARTON ROAD, STRATFORD, LONDON, E.15. Telephone: MARyland 6611

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DE LAVAL

SPECIALISED

EQUIPMENT

FOR THE CONTINUOUS

WASHING and DE-GREASING

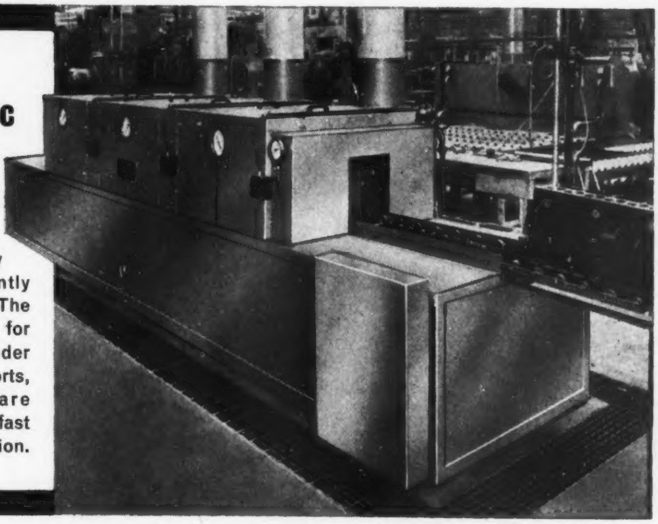
OF MASS PRODUCED COMPONENTS

De Laval design and construct washing and de-greasing plant exactly suited to your own needs, whether the components are large or small. The plant can include either hand or automatic spraying facilities using paraffin, white spirit or aqueous detergent. The washing fluid is continuously treated by centrifuge or filter, thus ensuring maximum throughput efficiency by the constant use of clean fluid.

DE LAVAL

COMPLETELY AUTOMATIC CONVEYOR PLANTS for the MOTOR INDUSTRY

The illustration shows a completely automatic conveyor plant recently supplied to Bean's Industries Ltd. The plant has been specially designed for the continuous washing of cylinder blocks, and ensures that valve ports, stud holes and all surfaces are thoroughly washed and dried at the fast rate necessary in large scale production.



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can help you

with the reclamation and centrifugal treatment of all types of washing fluids, machine shop oils and coolants. We gladly offer you the benefit of our extensive experience.

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FACTORY EQUIPMENT DIVISION

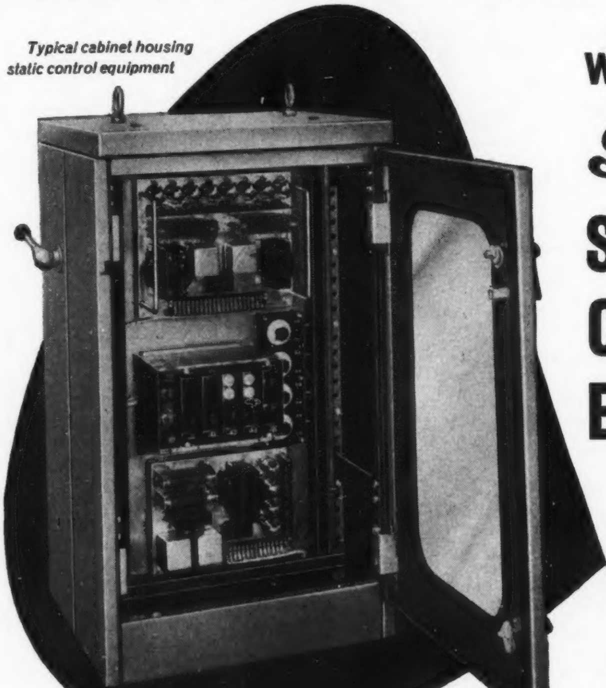
ALFA-LAVAL COMPANY LIMITED

Great West Road, Brentford, Middlesex

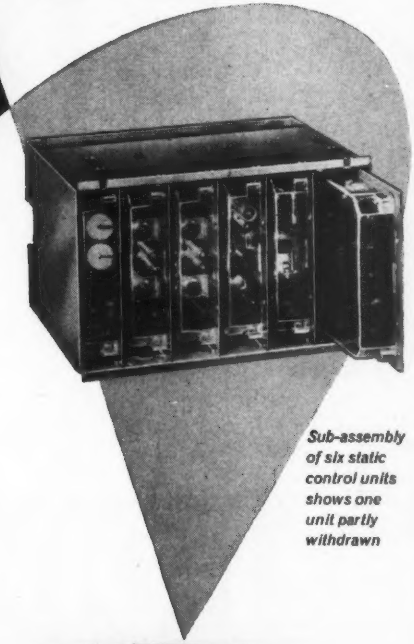
Smee's D.L.446

RELIABILITY THROUGH ELECTRONICS

Typical cabinet housing static control equipment



with G.E.C. STATIC CONTROL EQUIPMENT



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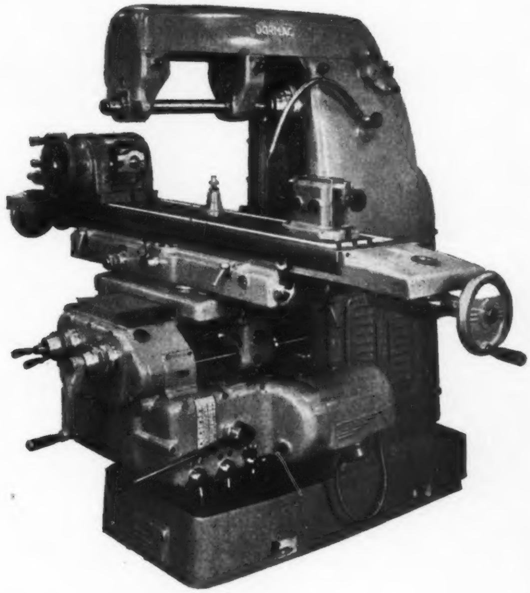

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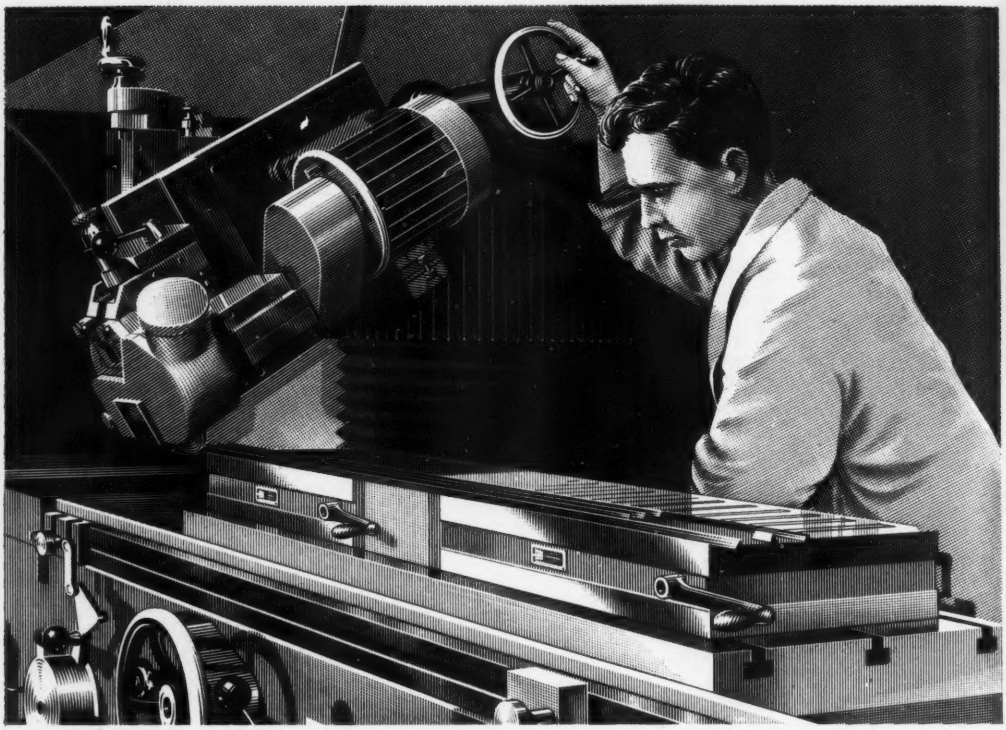

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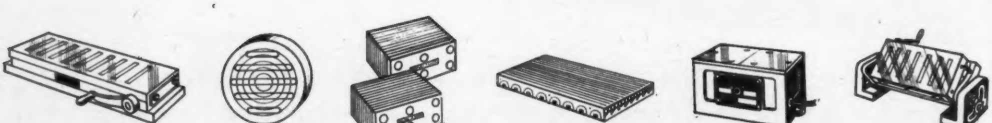

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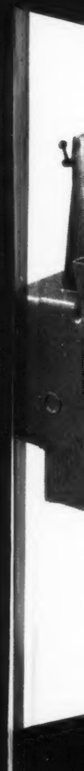

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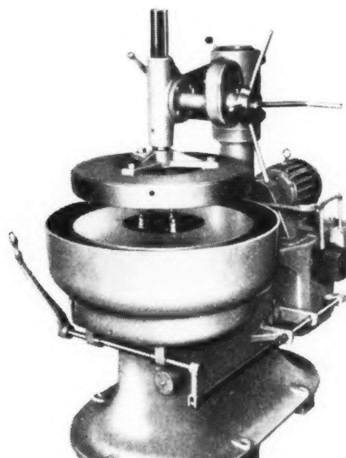

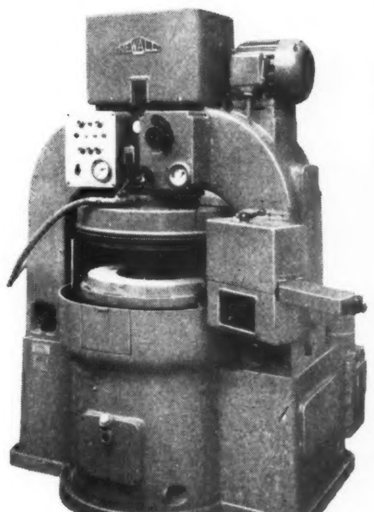

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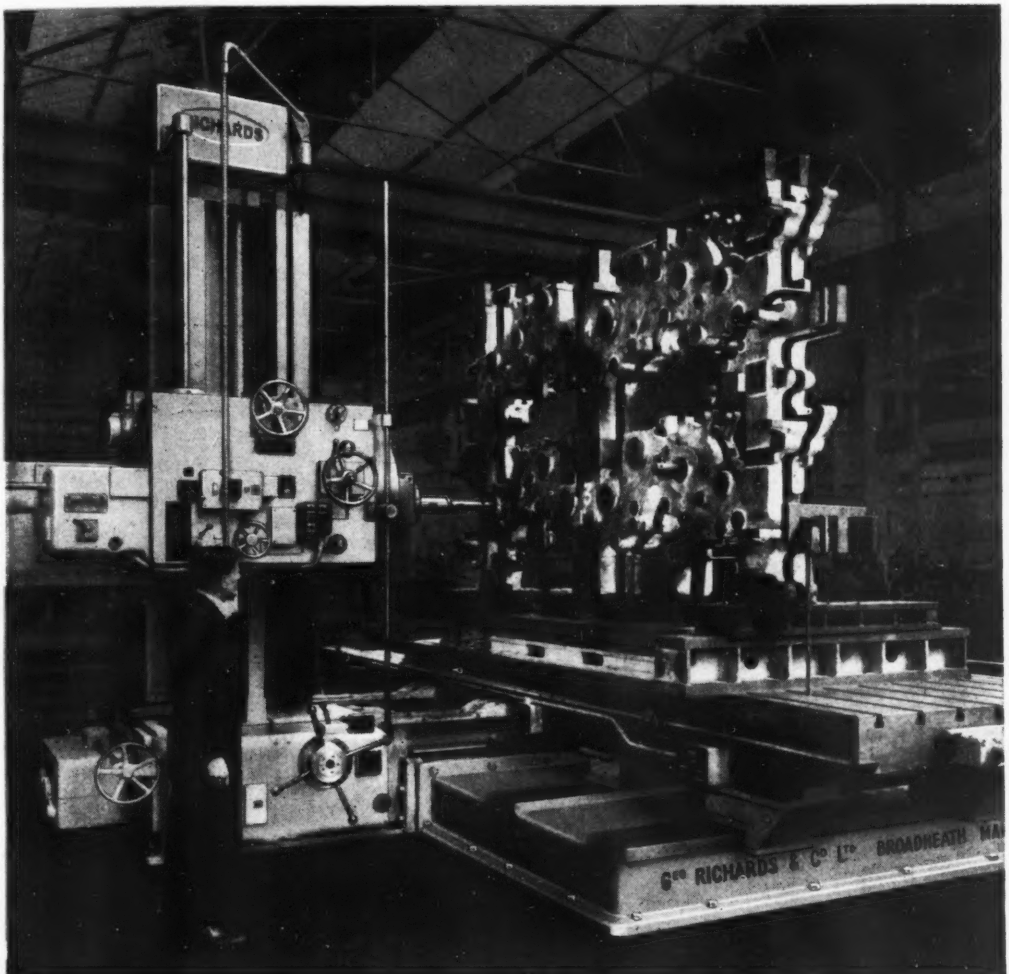
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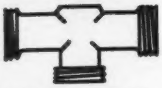
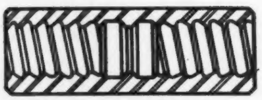
Wickman Moulton Thread Milling Machines



1 7/16" dia. Hob. 6 TPI, R.H.
Cutter Spindle Speed, 210 r.p.m.
Work Spindle Speed 3—5 m.p.r.
Material : Stainless Steel.

2" dia. Hob, 3 TPI
Acme thread, R.H.
CutterSpindleSpeed, 185 r.p.m.
Work Spindle Speed, 23 m.p.r.
Material : Steel forging.

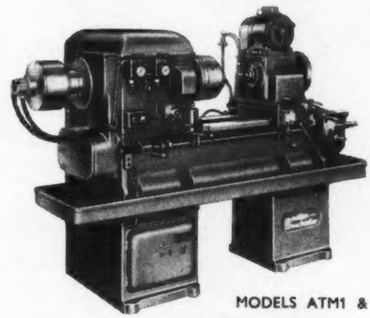


1¼" dia. Hob, 1·75 TPI. Special form, L.H.
Cutter Speed, 185 r.p.m.
Work Spindle Speed, 5 m.p.r.
Material : Steel.

3" dia. single Cutter, Acme thread, ¼" pitch, 12 Splines.
Cutter Spindle Speed, 122 r.p.m.
Lateral cutting speed, 2" p.m.
Material : EN.8.

3" dia. single Cutter, Acme thread, ¼" pitch, R.H., Helix angle 3°— 26′
Cutter Spindle Speed, 122 r.p.m.
Work Spindle Speed, 2 m.p.r.
Material : EN.8.

3" dia. single Cutter, Acme thread, ¼" pitch, R.H., Helix angle 4°— 55′
Cutter Spindle Speed, 122 r.p.m.
Work Spindle Speed, 3 m.p.r.
Material : EN.8.



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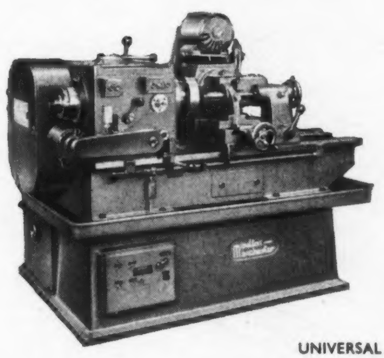

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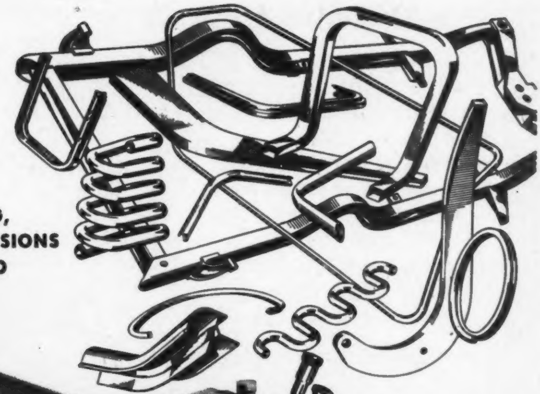

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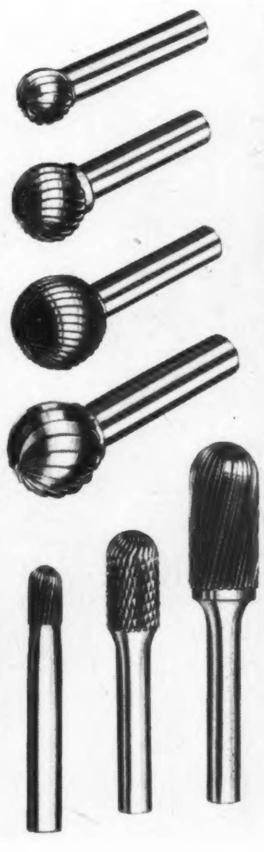

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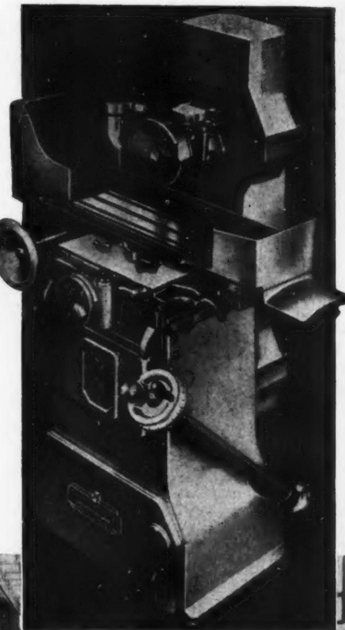

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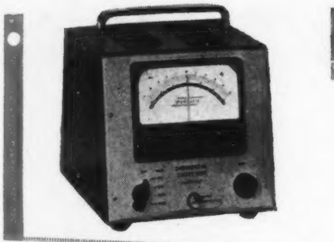

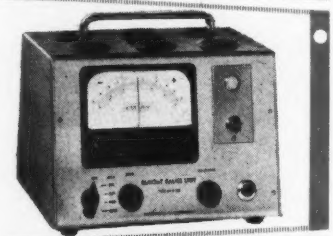

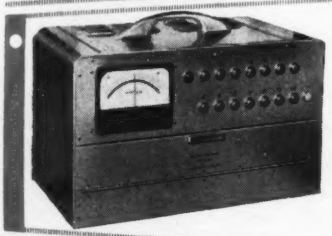

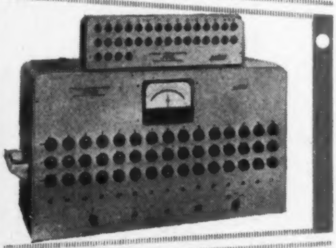

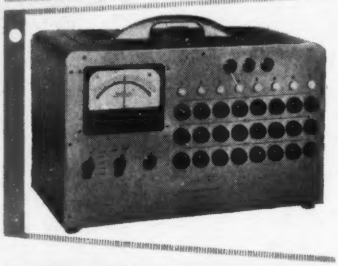

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Vol. 99, No. 2545 — August 23, 1961

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Abstracts of Principal Articles

Producing the Smiths Automatic Transmission .. .. P. 404

In this article, which is the second in a series concerned with the production of the Smiths automatic transmission at the company's Witney, Oxon., factory, reference is first made to the finish turning of inner rotors on a 2-spindle New Britain chucking automatic. The mechanism of the machine is briefly discussed, and the tooling, which incorporates provision for fine-setting, is described in detail. Inner rotors are checked with equipment that includes a Solex air gauge, and are mounted on trolley racks for transfer to the next machine in the sequence. On this machine, which is a Muller lathe with Eltropilot control, grooves are skived in the periphery, after it has been finish turned. Machining of stator front members on a Vertimax type 3 vertical production lathe is next considered, and the grinding of inner rotors and rear hubs is then described. On the latter components two surfaces are ground simultaneously by twin wheels. (MACHINERY, 99—23/8/61.)

Numerical Control Applied to Pratt & Whitney Machines for Inspection .. P. 413

Universal measuring machines equipped with numerical control, and in certain instances provided with means for tape recording the results, have been introduced by Pratt & Whitney Co., Inc., U.S.A. An 8-axis design is similar to one of the company's jig borers, and the three main slides, the ram and the rotary table are numerically controlled. A rotatable quill and associated swivel arrangement are manually controlled, and the machine will accommodate workpieces up to 100 in. diameter. A 2-axis machine has also been built, and two gauging heads allow inside and outside surfaces to be checked simultaneously. The company has recently developed a special automatic gauging unit with digital punched card read out. (MACHINERY, 99—23/8/61.)

The Application of Ultrasonics to Electroplating Processes .. .. .. P. 415

Ultrasonic energy is being applied to electroplating processes, for example, to disperse bubbles forming at the electrode faces, thus virtually eliminating anode polarization and cathode starvation, and increasing plating speeds. The cleaning action of ultrasonic vibration also has a marked effect on plating efficiency. High current densities can be used, with improved distribution of the coating, and deposits of purer form, with higher strength and hardness are produced. (MACHINERY, 99—23/8/61.)

Set-up for Producing a Safety Razor Component on a Multi-spindle Automatic P. 417

A total of 13 operations are required to produce a safety razor component on a $\frac{9}{16}$-in. Acme-Gridley 6-spindle bar automatic. The sequence provides for number rolling, knurling and broaching, and parts are produced from $\frac{5}{8}$-in. diameter brass bar in a cycle time of 4·5 sec. A spindle speed of 2,140 r.p.m. is used, and an output of 600 pieces per hour is consistently maintained. (MACHINERY, 99—23/8/61.)

Factors Affecting the Choice of Inserted-blade or Throw-away Tip Milling Cutters P. 421

A recent investigation by the Wesson Co., U.S.A., has indicated that 95 per cent of the firms surveyed used throw-away tip face milling cutters for either finishing or roughing, or both, although none of the firms used this type of cutter for more than half of the rough milling operations performed. The factors influencing the choice of cutter are here considered. (MACHINERY, 99—23/8/61.)

Trials of Cylinder Block Die Casting Machine .. .. P. 436

A new 2,500-ton cold chamber die casting machine for the production of cylinder blocks for the engine of the Russian Volga car has recently undergone full-scale trials at the Triulzi works, Milan, Italy. Of direct hydraulic type, the machine is arranged for a maximum injection capacity of 100 lb., with final pressure on the metal of 28,500 lb. The platens are 6 ft. square, and the clearance between the tie bars is 51 in. Die thickness is variable between 2 ft. 3 in. and 4 ft., and the die opening stroke is 5 ft. Cylinder block castings of sound quality and good finish were produced at a rate of 15 per hour, and a rate of 23 to 25 blocks per hour is expected on production. (MACHINERY, 99—23/8/61.)

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If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

Metal Cutting with the Plasma Torch

Attention has previously been drawn in MACHINERY to some important actual and potential applications of recently developed equipment whereby very high arc plasma temperatures are obtained. Torches are now available, for example, which enable a great variety of metals and other materials with high melting points to be deposited by the well-known spraying technique, either for the purpose of providing surface coatings with special properties, or for building up components from substances with characteristics that would render production by other methods difficult or impossible. Here, the electric arc, which is the source of heat, is confined within the body of the torch, and the jet of hot gas that emerges corresponds to the flame obtained with other types of equipment where reliance is placed on chemical combustion. For such operations as welding and cutting, however, where maximum heat transfer is required, it is preferable to employ a generator of the transferred-arc type. To this end, an exterior anode is provided and both the arc and the gas stream are projected from the nozzle of the torch. When cutting is to be performed the workpiece is the anode.

It is unnecessary to emphasize the great value of flame—and in some circumstances of conventional electric arc—cutting operations in many branches of metal working, and any alternative which enables speeds of working to be increased and the field of application to be extended is obviously of great significance. As was pointed out by Mr. James A. Browning and Mr. George A. Klasson during the course of a paper read before the American Society of Mechanical Engineers, transferred-arc plasma torches have been employed for metal cutting on a limited scale for several years. Originally, this method was largely confined to operations on non-ferrous metals and other materials which could not be cut with an oxygen flame, but as a result of more recent investigations, it is stated, the plasma process is now competitive for cutting mild steel.

Although the theory of arc-plasma cutting is not yet well understood, it is known that voltage is of great importance, and it has been found that when the arc is stabilized by a strong vortex gas whirl, much higher voltages and powers can be employed. This gas motion serves to centralize the arc in the nozzle opening and effectively separates it from the walls. To determine the influence of voltage, trials were carried out on 1½ in. thick plate at various values between 140 and 240, the power level being kept constant. Under these conditions, it was found that the maximum cutting speeds for the lower and higher voltages were 30 and 50 in. per min., respectively. Other tests indicated that the lower the voltage the more pronounced is the vee form of the cut, particularly where the material thickness is less than 1 in., whereas voltages in excess of 200 result in vertical edges. Moreover, the higher the voltage, within the range employed for test purposes, the smoother was the cut obtained.

The facility which the arc-plasma torch affords for cutting all conducting materials is obviously of great advantage, and in this connection it is reported that operations can be carried out at high speeds on aluminium, cast iron, copper, brass, nickel and stainless steel, and that even tungsten will not resist the action. It may be noted for instance that 2-in. thick aluminium has been cut at 120 in. per min. with a power consumption of 200 kW., and ¾-in. thick copper at 80 in. per min., with a consumption of 155 kW.

Important as are these results, however, it is the progress that is being made in the field of mild steel cutting that will command particular attention. The authors of the paper report that tests were carried out on this material in thicknesses ranging from ¼ in. to 3 in. and that the corresponding maximum speeds obtainable were found to vary from 525 to 20 in. per min. Voltages between 220 and 270 were employed and it is believed that for the thicker sections, higher voltage values might enable better results to be achieved. It should also be noted that for the 3-in. material the power employed (210 kW.) was the maximum available. The plasma gas used for the experiments consisted of about 70 per cent nitrogen and the remainder hydrogen, and there was comparatively little difference in the gas flow required for cutting, for example, ¾-in. plate at 100 in. per min., and 2-in. plate at 40 in. per min.

Not only are the cutting speeds achieved with the arc-plasma process very much higher than those recommended for the oxy-acetylene method, but the cost of operation per unit length cut was found to be much lower, particularly for the thinner plates. On the other hand, the flame cutting equipment is simpler and much less expensive

(*Continued on page* 453)

Producing the Smiths Automatic Transmission

Methods and Equipment Employed for the Manufacture of Components for this Ingenious Electro-mechanical Unit at the Witney Factory of S. Smith & Sons (England), Ltd.

By P. A. SIDDERS, Chief Associate Editor

IN THE FIRST ARTICLE* in this series devoted to the production of the Smiths automatic transmission, reference was made to the design of the unit, and its mode of operation, also to certain of the production facilities at the Witney, Oxon., factory of S. Smith & Sons (England), Ltd. It was pointed out that most of the principal components are of cylindrical or disc shape, and are made from press- or drop-forgings in En.2a/1 steel, which has the necessarily low carbon content to ensure good magnetic permeability and low remanence. Most of the operations on the forgings are performed on a battery of machines, comprising ten Max Muller multi-tool lathes, a Drummond Maximinor lathe, a Vertimax No. 3 vertical chucking lathe, and two New Britain type 36 twin-spindle chucking automatics. In the article reference was made to the rough turning of front inner rotors, finish turning of rear inner rotors and finish turning of rear outer rotors, all on Muller lathes, with Eltropilot control, and the latter system was considered in some detail. Further operations on inner and outer rotors and front stators are here described.

* MACHINERY, 99/60—12/7/61.

After the machining sequences on Muller lathes considered in the earlier article, front and rear inner rotors are subjected to a series of turning operations on Swiss-built New Britain type 36, 2-spindle chucking automatics (Vaughan Associates, Ltd.). A rear inner rotor is seen at the left in Fig. 1, after the operations on the New Britain machines, which provide for turning the spigot *A* to a tolerance of $\pm 0{\cdot}0005$ in., machining the face at the inner end of the spigot, also the rim face *B*, and forming a circlip groove *C* in the spigot.

TURNING OPERATIONS ON NEW BRITAIN AUTOMATICS

Fig. 2 is a general view of the New Britain chucking automatic, with the guard *D*, which normally encloses the cutting zone, swung clear to show the air-operated chucks fitted to the spindles. These chucks are opened and closed by means of the pedal *E*, and once the spindles are running, this pedal is rendered non-effective, to prevent accidental release of the workpieces. The spindles are driven by belt from a motor, of 3 h.p., mounted on top of the headstock, and for this operation sequence, the spindle speed is 900 r.p.m.

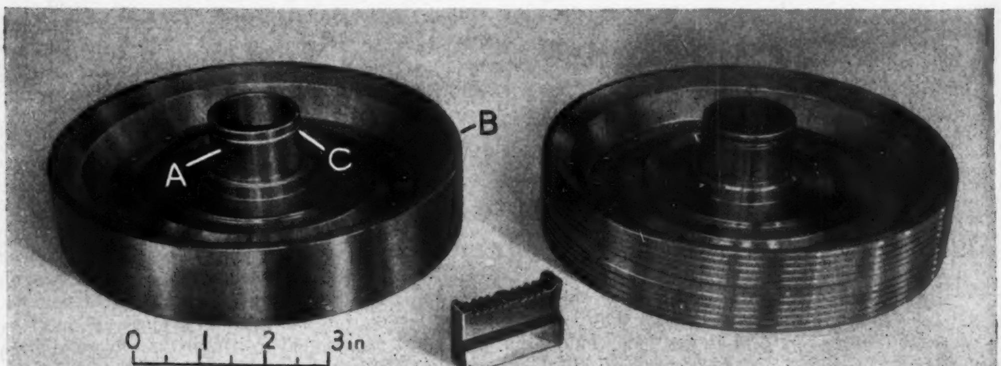


Fig. 1. A rear inner rotor for the Smiths automatic transmission is seen at the left ready for the production of grooves by skiving, and at the right, after the skiving operation. A skiving tool is also shown

Fig. 2. General view of a Swiss-built New Britain 2-spindle automatic chucking lathe set-up for operations on inner rotors at the Smiths Witney factory

The machine bed has inverted-V and flat guideways, whereon slides a saddle with cam-controlled longitudinal motion. An air cylinder is mounted on the bed below the saddle, and the piston rod is coupled to the latter member. Pressure is exerted by the cylinder to hold a follower against the periphery of a disc cam, which controls the movements of the saddle during the machining cycle. The air cylinder also provides for rapid advance and return of the saddle at the beginning and end of the cycle.

On top of the saddle there is a transverse slide, whereon the toolholders are mounted. Motion of this slide is derived from an air cylinder within the machine bed, and is controlled by a disc cam, mounted on the same shaft as the saddle cam. In consequence, the cams—and the associated saddle and slide—are moved in phase, and compound tool motions can be provided for machining angular faces, steps, and convex or concave forms.

Access to the camshaft is gained by way of the cover *F*, and the interior of the headstock may be seen in Fig. 3, which is a close-up view of the machine with the cover *F* removed. An air cylinder for operating one of the spindle chucks is indicated at *G*, the cam for the cross-slide, at *H*, and the cam for the saddle, at *J*. Each cam is engaged by a chisel-ended follower, and the follower which engages the cam *J* is fitted to a bar connected directly to the saddle. At the rear, there are two arms with felt wiper pads, which are held in contact with the peripheries of the cams to remove any foreign matter. At *K* is seen a micro-switch for controlling the rapid approach movement of the saddle. Powered by the longitudinal air cylinder, the saddle is rapidly advanced towards the work until this micro-switch is tripped, and the feed rate is then reduced in readiness for control by the saddle cam. The position at which the rapid advance motion terminates is adjustable to suit the work.

For stopping the machine cycle, there is a disc cam on an auxiliary shaft within the housing *L*, Fig. 2. This cam cuts off the electrical supply to both the spindle and feed motors, and engages the air-operated rapid-withdrawal motion. When fresh components have been loaded, the operator presses a button on the panel at the front of the machine to start the next cycle. It may be mentioned here that cams can be mounted on the

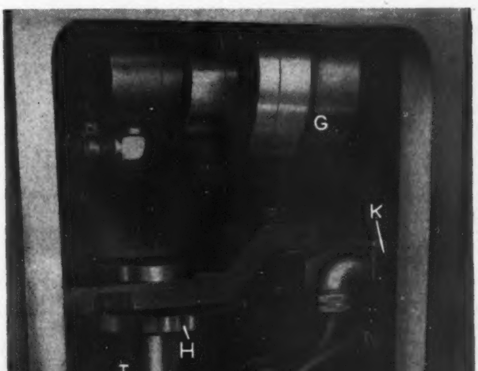


Fig. 3. Close-up view of the headstock of the New Britain machine showing the cams for operation of the traverse motions for the saddle and cross-slide, also a limit switch for terminating the rapid approach motion and one of the chucking air cylinders

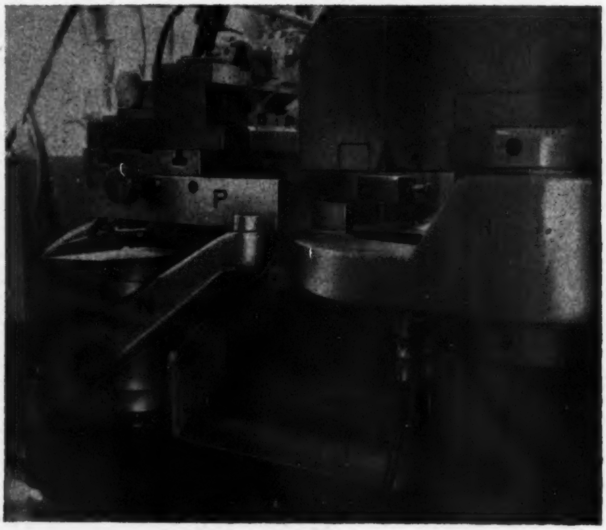


Fig. 4. In this view of the New Britain automatic from the rear, may be seen the cam-operated lever for applying movement to the cross-slide, also the associated air-cylinder and lever for applying back pressure to the slide

auxiliary shaft to control automatic loading equipment and other units, also to control a variable-speed motor when it is required to employ constant cutting speed for facing operations.

Fig. 4 is a view of the machine from the rear, and the end of the air cylinder associated with the cross-slide is seen at *M*. Force is applied by the lever *N*, which carries a roller that bears against the bar *P*, secured to the end of the slide. This bar is engaged by a swivelling block fitted to the lever *R*, which is of L-shape in plan, and the other arm of this lever is connected to a slide that carries the cam follower.

TOOLING ARRANGEMENTS ON THE NEW BRITAIN AUTOMATIC

The arrangements for holding the work and tools are shown in Fig. 5. Each chuck has three special jaws, as at *S*, which grip the periphery of the workpiece, and the latter is loaded so that its rear face is in contact with three hardened steel pillars that project from the chuck body, as at *T*. The machine spindles are arranged to run in a clockwise direction, as viewed from the saddle end of the bed.

For each component in the machine chucks there are three cutting tools mounted in holders on the cross-slide. A block *U* supports a Sandvik Coromant T-max clamped-tip tool *V*, for facing the front of the workpiece. The shank of this tool has two slots and is directly clamped by two socket-head screws and washers. A hole is tapped in the shank, at the end remote from the tip, and is engaged by a screw that provides for longitudinal adjustment. This screw has an annular groove at the head end which engages a slotted plate secured to the support block.

A single-point tool *W*, with a brazed-on Sandvik carbide tip, serves for turning the spigot and machining the adjacent shoulder face. This tool is mounted in a closed-end slot in a holder, in which it can be adjusted by means of a socket-head grub screw. The tool holder is arranged to slide in a groove in a support block *X*, and can be adjusted axially by two screws. Once it has been set, it is clamped by two hexagon-head screws. The support block *X* is arranged to swing about a vertical pivot on an intermediate plate *Y*, which, in turn, is axially adjustable on a base *Z*, the latter member being secured to the cross-slide. To facilitate setting the tool *W*, the support block *X* is provided with micrometer adjustment. The end of the block remote from the tool is machined to form a tongue, and has a hole to receive the shank of a horizontally-disposed adjusting screw. This screw has a large knurled head, as seen at *A*, on the periphery of which there are divisions, each representing approximately 0·0001 in. of radial movement of the tool point. Heavier division marks indicate each 0·0005 in. of movement, and the tongue of the support block is split and fitted with a clamp screw to take up play. The threaded end of the screw engages a tapped hole in a block secured to the intermediate plate *Y*, and the calibrations are read with reference to a sheet-steel pointer on the support block.

The third tool provides for cutting the circlip groove in the spigot, and is indicated at *B*. Tipped with Sandvik carbide, and inverted, this tool is mounted in an L-shaped holder *C*, which is also seen in Fig. 6. The tool can be adjusted in the holder, radially relative to the work, by means of a socket-head grub-screw, and the holder can be adjusted axially in a groove in the support block *D*. Setting of the holder is facilitated by the provision of two screws, one arranged to push and

the other to pull. The support block D can slide on an intermediate plate E, guided by a transverse key, and a screw F is fitted to facilitate transverse adjustment. As with the tool-mounting arrangements discussed earlier, the intermediate plate is mounted in a shallow groove in a base member as indicated at G.

During the machining cycle, a mixture of soluble oil emulsion and air is delivered to the work in the form of a fine spray, by means of Enots (Benton & Stone, Ltd.) equipment. An atomizing nozzle for this equipment is seen at H, and is supported by a simple bracket secured to the holder for the turning tool (W, Fig. 5) by one of the clamping screws. The machine cycle comprises rapid advance of the saddle; feed of the saddle for turning the spigot; transverse feed of the slide, with the saddle stationary, for facing and plunge-forming the circlip groove; withdrawal of the slide; and rapid return of the saddle. This cycle is completed in 1·25 min. It has been found that the turning tool requires servicing after 300 components have been machined, and the facing and grooving tools, after 150 to 200 components.

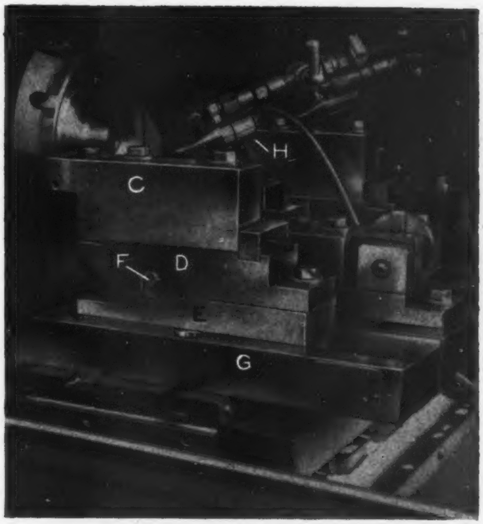


Fig. 6. Close-up view of one of the holders for grooving tools on the New Britain machine, showing the provisions for longitudinal and transverse adjustment, also the Enots atomizing nozzle for the supply of mist coolant

CHECKING EQUIPMENT

Equipment for checking the work is installed adjacent to the New Britain machines and is shown in Fig. 7. A Solex ring-type air gauge J is provided for checking the diameter of the spigot, which must be held to 1·1798/1·1808 in., the size being indicated on the manometer unit at the right. The face of the shoulder K at the inner end of the spigot must be machined to 1·155/1·161 in. from the back face of the rim (used for endwise location during the machining operations described). This distance is checked by means of a plate L, with a flat, ground upper surface, which has a datum peg projecting upwards. A component is loaded over the peg, so that the rear face of

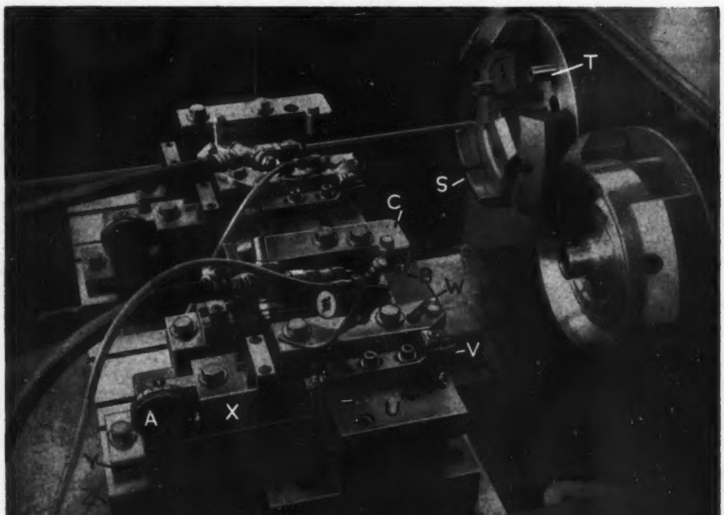


Fig. 5. The tooling on the New Britain chucking automatic viewed from above and to the rear. There are two groups of tools, each comprising units for turning, facing and grooving

Fig. 7. Checking equipment for inner rotors after the operations on the New Britain machine. It includes a Solex air plug gauge for checking the diameter of the spigot

the rim rests on the surface of the plate, as seen in the illustration. A gauge ring is then placed over the spigot. This gauge, seen at *M*, has a stepped upper face, the step surfaces being checked by feel, relative to the upper end of the peg, to determine whether the distance between the shoulder face of the component and the back face of the rim is within the specified limits.

A dial indicator gauge, on a stand with a magnetic base, is used to check the overall width of the rim, with the component mounted on the plate *L*. A cylindrical master block is placed on the plate for setting the indicator gauge to zero.

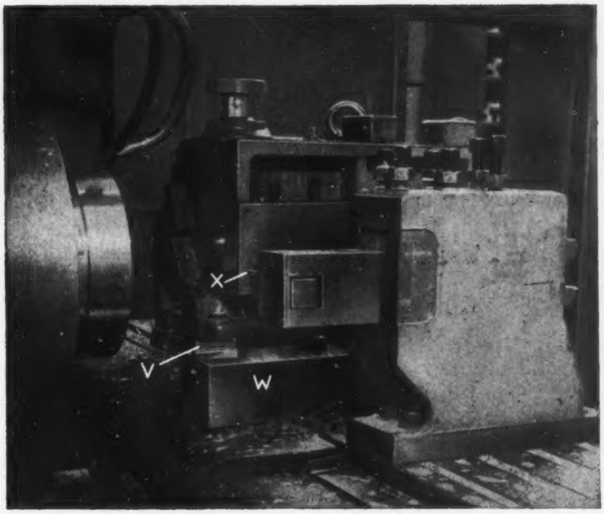
The "go and not-go" gauge *N* provides for checking the width of the circlip groove, and the root diameter of this groove is checked with the aid of the "go and not-go" gap gauge *P*. A gauge ring *R*, with sliding feelers, is employed for checking the axial position of the groove.

TROLLEY RACKS

For transport of semi-finished and finished parts throughout the machine shops at the Smiths Witney plant, extensive use is made of trolley racks supplied by Rack Engineering, Ltd. A typical unit, seen in Fig. 8, serves for transport of inner rotors from the New Britain automatics to the next machine in the manufacturing sequence. Of standardized design, each unit comprises a base S, with two castoring and two fixed wheels, and on the base is welded a nominally vertical frame. The frame comprises two side members, of shallow inverted-V form, constructed from steel angle by welding, and cross braced. Each front element slopes back slightly from bottom to top, and has inclined slots which provide for mounting transverse supports, as at *T*. Each support is of welded construction and has a flat back member and a corrugated front member. The corrugations form a series of pockets to receive hooks that are integral with work carriers, as at *U*. This

Fig. 8. One of the trolley racks supplied by Rack Engineering, Ltd., which are widely used throughout the Smiths Witney transmission factory. The basic trolley is readily adaptable for handling a variety of components and sub-assemblies

Fig. 9. Close-up view of the tools on a Muller Eltropilot lathe which provide for turning the periphery, also skiving a series of grooves and a radius at either end



work carrier is typical of those used for cylindrical or disc-shaped components with central holes, but other types are used, some of which take the form of trays. Work carriers can be spaced on the supports and the supports arranged on the frame of the trolley to suit the shape and size of the components to be handled. As may be seen, more than one component can be mounted on a carrier, and in this instance, six inner rotors are stacked on each, with sheets of corrugated cardboard between them, to protect the machined faces. Work is stored on the trolley racks, to reduce handling and the risk of damage, and the racks can be located adjacent to machines in positions convenient for loading and unloading.

SKIVING OPERATION ON INNER ROTORS

Following the operations on the New Britain automatics, inner rotors are drilled for subsequent assembly of spring drive units and covers, and the final sequence of cutting operations provides for turning the periphery to a tolerance of $\pm 0{\cdot}002$ in., also forming a radius on each end of the rim and producing a series of grooves in the periphery by skiving. These operations are performed on a Muller type 187B lathe, with Eltropilot control, and the component is then finished by grinding.

A rear inner rotor is seen at the right in Fig. 1, after the operations on the Muller machine have been completed. It will be observed that there is a broad central groove round the periphery, with a group of four V-section grooves on either side. Each of the latter is of 90 deg. included angle, and the depth of all the grooves is nominally 0·065 in. Between the two components in Fig. 1 is seen a skiving tool, and these units are normally made from high-speed steel by an outside supplier. The particular tool shown has been impregnated with tungsten carbide on the top rake face for experimental purposes, and the results so far obtained with this treated tool have been very promising.

Fig. 9 is a general view of the set-up on the Muller lathe, which, it may be mentioned, has a range of eight feed rates, any four of which can be engaged automatically during the machining programme. The component is loaded on to a fixture on the machine spindle, and is located by means of the spigot (*A*, Fig. 1) and the annular flat face (*B*, Fig. 1) at the end of the rim, which bears against a facing on the fixture. A bolt is passed through the central hole in the component and is screwed into an air-operated draw-bar in the lathe spindle. A washer on the bolt is pulled into contact with the boss of the component to clamp the latter on the fixture.

The skiving tool is indicated at *V*, Fig. 9, and it is mounted in a groove machined in a heavy-section steel block *W*, bolted to the slide of the lathe. Held in the groove by grub screws, the tool rests on two screws that provide for adjusting the height of the cutting edges. Normally, from 85 to 100 components can be machined before the tool needs to be serviced. The turning tool for machining the periphery is indicated at *X*, and is of the Sandvik Coromant T-max clamped-tip type. A lip is ground across each corner of the tip to provide a positive rake of 15 deg., as this form has been found to eliminate chatter. The turning tool tip can usually be employed to machine 250 components before it needs to be indexed.

Skiving is performed at the end of the longitudinal traverse, with the cross-slide of the machine moving from the rear towards the front of the saddle, so that the turning tool travels away from

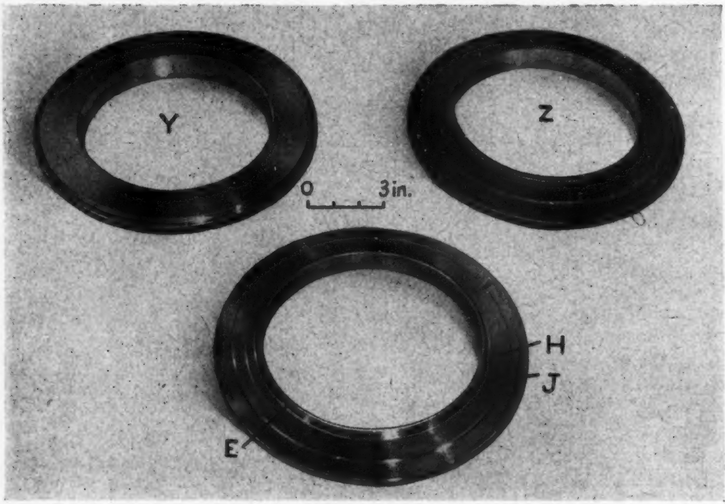


Fig. 10. Stator front members at various stages in the production sequence. Forgings (one inverted) are seen at the rear after the first machining stage, and at the front a component after the second stage

the component. A feed rate of 0·012 in. per rev. is used for both the longitudinal and transverse cutting movements, and the spindle speeds employed are 405 r.p.m. for turning and 200 r.p.m. for skiving. Soluble oil emulsion is used as a coolant, and the cycle time for this operation sequence is 2 min. 14 sec.

TURNING OPERATIONS ON STATOR FRONT MEMBERS

When the Smiths automatic transmission is assembled, the inner rotors are free to rotate inside outer rotors, which, in turn, can rotate in a stator assembly. The outer rotors are driven from the engine of the car, and connection is made between the outer rotors and either of the inner rotors by means of very fine chromium iron powder, when the corresponding coil in the stator assembly is energized. Of built-up construction, the stator comprises a central portion, to which are secured front and rear members, and the machining of the stator front member will now be considered.

These front members are turned in two stages on the Vertimax No. 3 machine to which reference has already been made. At the first stage, the ring-type forging is machined in the bore and on one side, as seen at *Y* in Fig. 10. Another component is shown inverted at Z, where the rough, forged, side to be machined at the second stage may be observed. In the foreground is a component after the second turning stage has been completed.

Fig. 11 is a close-up view of the set-up for the second stage on the Vertimax machine. It may be recalled that the machine has two independent slide units, each supported on a vertical steel column. There is a column on either side of the vertical work spindle, housed in the machine base, and the column and slide assemblies are pneumatically counterbalanced. The outboard end of each slide unit can be clamped to a vertical bracket on the base, to form a "closed frame" structure. Each slide proper travels on hardened and ground guideways and the slide assembly can be swivelled from a setting below the horizontal to beyond the vertical. Positive dead stops are incorporated for accurate control of the slide movements, which are hydraulically powered. The feed mechanism provides pulsations which serve to break-up the swarf, and the slides can be rapidly advanced and withdrawn. Feed rates for each slide are independently and steplessly variable. A motor of 30 h.p. is provided for the No. 3 machine, which has a maximum swing capacity of 24 in. diameter, the maximum travel of the tool slides being 8½ in.

A stator front member is indicated at *A*, and is supported on three screws fitted to blocks mounted on the face of the chuck *B*, on the machine spindle. Three turned jaws, as at *C*, grip the previously-machined bore of the component. For the operations to be described, the spindle is run at 217 r.p.m. The left-hand slide of the machine is set at 24½ deg. to the vertical and is fitted with holders to carry three tools. As the slide is fed downwards, the Sandvik tipped tool *D* machines a chamfer at the end of the main bore of the component; the Sandvik Coromant T-max, clamped-tip, tool *E* machines the tapered surface *E*, Fig. 10, and a similar tool *F* forms a chamfer on the periphery.

The right-hand slide of the machine carries

holders for five closely-grouped tools, and is advanced horizontally. Three Sandvik Coromant T-max, clamped-tip, tools, as at *G*, Fig. 11, serve to face the two step surfaces *H* and *J*, Fig. 10, also the flange surrounding the bore. The distance between the surfaces *H* and *J* is held to 0·123/0·127 in. and the overall thickness to 1·040/1·050 in. Since the vertical face between the surfaces *H* and *J* is used for location on assembly, it is machined by the outer tool of the three to a diameter of 9·837/9·847. The Sandvik brazed tip tool *K*, Fig. 11, provides for machining the periphery of the component to 11·267/11·277 in. diameter, and the Ardoloy tool *L*, at the rear, forms a chamfer at the lower edge of the periphery.

Both slides operate together, and the cycle time for the operations is 66 sec. The coolant is a soluble oil emulsion, and about ⅛ in. of metal (a side) is removed from all surfaces. It has been found that 70 to 80 components can be machined before the tools need to be reground or a tip indexed.

GRINDING INNER ROTORS

To maintain the magnetic properties, components of the Smiths automatic transmission are not heat-

Fig. 11. Close-up view of the set-up for the second machining stage on stator front members on the Vertimax lathe. One tool slide is set horizontally for machining a series of faces, and the other, at 24½ deg. for turning a taper annular rib and chamfering

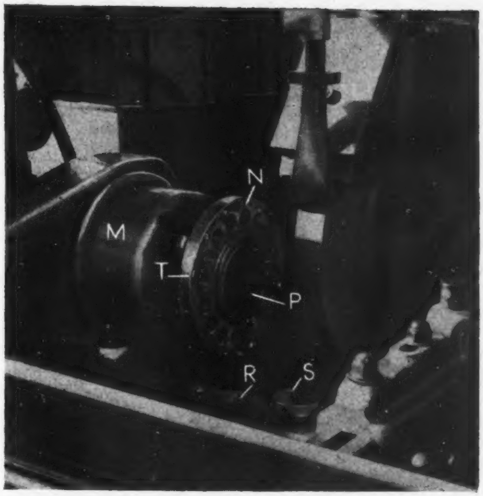


Fig. 12. Equipment on a Jones-Shipman grinding machine for holding inner rotors during finishing operations on the periphery after skiving. Interchangeable location plates provide for holding front and rear units

treated, but those surfaces that are subject to wear are hard chromium plated. Procedures and equipment for plating will be considered in a subsequent article. Prior to plating, inner rotors are cylindrically ground after the skiving operation already described. Similar set-ups are used for grinding both types of inner rotor, but the diameters after grinding differ, since the thickness of the hard chromium deposit on front inner rotors is 0·0010/0·0015 in., and on rear inner rotors, 0·0005/0·0010 in.

A Jones-Shipman type 1052/EF universal machine is used for grinding both types of inner rotor. A Philips universal clarifier is provided for the soluble oil coolant, and the internal grinding head, normally fitted to the machine, has been removed. A Woodworth diaphragm chuck (F. Pratt & Co., Ltd.) is fitted to the spindle of the machine for holding other workpieces and is operated by Pratt pneumatic equipment. Fig. 12 is a close-up view of the work zone of the machine, and the diaphragm chuck is seen at *M*. In this instance, the chuck is not used to grip the work directly, but serves to hold a fixture *N*. This fixture has a steel main plate, drilled with lightening holes, at the centre of which is fitted an interchangeable location plate *P*. Through the register bore of the location plate protrudes a clamping

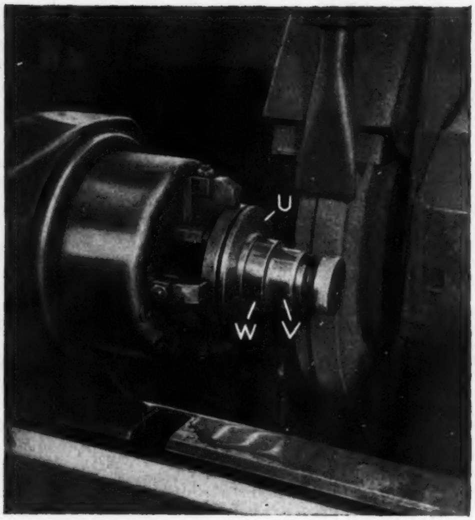


Fig. 13. The set-up for grinding rear hubs on a Jones-Shipman machine, fitted with two abrasive wheels separated by a spacer. Grinding is performed in roughing and finishing stages

stud, whereon can be mounted a clamp plate *R* and a nut *S*. There are three hard pads, as at *T*, equally spaced round the front of the main plate, near the periphery. Location plates are available with bores to suit the spigots of the front and rear inner rotors, and each rotor is loaded over the clamping stud, so that the spigot enters the bore in the location plate and the rim face (*B*, Fig. 1) abuts the hard pads on the main plate. The component is then secured by the plate *R* and the nut *S*.

A Universal type C46/60LY2V abrasive wheel is employed for grinding the inner rotors and is run at 1,250 r.p.m., which provides a surface speed of 5,000 ft. per min. The work is run at a speed of 40 r.p.m., and grinding is carried out by the plunge-and-traverse method, from 0·0025 to 0·0045 in. of metal (a side) being removed. Solex gauging equipment is provided for checking the component after grinding.

GRINDING REAR HUBS

A somewhat similar set-up is employed for grinding two surfaces simultaneously on rear hubs for the automatic transmission, these surfaces later being hard chromium plated. Grinding is performed in roughing and finishing stages on a Jones-Shipman machine, each stage being performed on a complete batch of components. A close-up view of the set-up on the Jones-Shipman grinder is given in Fig. 13, and the workpiece is indicated at *U*. Rear hubs are machined from forgings by a series of operations on the Maximinor lathe in the turning section, and after the grinding stage, holes for fixing bolts are drilled in the flange of each component. A rear hub is fitted to the end of the rear outer rotor, and on the side of the flange nearest to the chuck in Fig. 13 there is a register spigot that is concentric with a bore for an oil seal. The ground portion at *V* on the body of the hub provides for mounting a ball bearing, and the portion at *W* is engaged by an oil seal fitted to the end plate of the transmission unit.

A Woodworth diaphragm chuck is again used to hold a fixture, on which the work is clamped by means of a stud, C-washer, and knurled nut. The component is located by the register bore for the oil seal at the rear of the flange. Two wheels, separated by a spacer, are used for grinding the two surfaces, and, as for the operation described earlier, are run at 5,000 ft. per min. The work is run at 60 r.p.m., and from 0·003 to 0·004 in. of metal is left on the surfaces at the roughing stage for removal during finish grinding. Abrasive wheels of Norton type A80-L-6V6 are employed for both stages.

After finish grinding, the diameter of the surface *W* is checked with a micrometer, and that of the surface *V* with Solex air gauging equipment. This equipment comprises a ring gauge with a central spring-loaded pad to support the component. Rear hubs are then passed to a Pollard machine, fitted with a Mulhead 2-station multispindle adapter, for drilling six fixing holes, also three oil release holes. Hubs are supported on simple ring-type location members, and that for the oil release hole stage incorporates a peg, which engages one of the previously-drilled fixing holes, to position the work angularly.

Other equipment and procedures for the production of the Smiths automatic transmission at the Witney factory will be described in a further article in this series, to be published shortly in MACHINERY.

PRODUCTION OF ELECTRONIC COMPUTERS in the U.K. during the first quarter of this year had a total value of £2,403,000, and computers to the value of £320,000 were exported. The corresponding values for last year were £2,036,000 and £494,000, and for 1959, were £1,654,000 and £245,000.

Numerical Control Applied to Pratt & Whitney Machines for Inspection

RECENTLY-DEVELOPED UNIVERSAL measuring machines equipped for numerical control provide for rapidly and automatically checking even very complicated components. Extremely accurate measuring systems are incorporated, and from inspection procedure data on punched tape, gauging points can be automatically located at any positions within the traverse limits of the machine. In addition to being arranged for tape input, some machines can provide tape output for recording inspection results. Special-purpose tape-controlled measuring machines for inspecting particular parts are also in use.

A universal type numerically-controlled measuring machine of 8-axis design is seen in Fig. 1. Developed by Pratt & Whitney Co. Inc., West Hartford, Conn., U.S.A., this equipment is similar to the jig borers made by the company, but is provided with a more highly refined measuring system and several additional axes of motion. The principle of using a jig borer for checking workpieces machined on less accurate equipment is not new. Even parts that have been machined on a jig borer are sometimes checked on the same machine by repeating the operation sequence, with a dial gauge substituted for the cutter. Deflections of the gauge pointer indicate mistakes by the operator, or inaccuracies introduced by deflection due to high contact pressures between the tool and the work. They may also be caused by distortion resulting from clamping, which is revealed after the clamps have been released and then lightly re-applied for the checking operation.

On the 8-axis measuring machine seen in Fig. 1, the three main slides, the ram, and the built-in rotary table are numerically controlled. A rotatable quill and an associated swivel arrangement are arranged for motor drive, but settings with reference to optical scales are manually controlled by means of push-buttons. The swivel arrangement and quill provide for inspection of the location, alignment, and concentricity of a hole or curved surface with an axis at a simple or compound angle to the main axes of the workpiece. In Fig. 2, the operator is seen setting the motorized quill, by push-button control, with reference to an optical scale. For the complete inspection of most parts only the five tape controlled movements are required. A small Trans-O-Limit electronic gauge head is mounted on the quill spindle. This machine will accommodate workpieces up to 100 in. diameter.

A 2-axis numerically-controlled measuring machine, based on a jig borer, has also been built by the Pratt & Whitney Co. On this machine, a square quill replaces the usual cylindrical quill to provide greater accuracy. Deviations from nominal dimensions can be indicated visually, by chart, or by digital read out.

By means of two gauging heads, the inside and outside surfaces and the thicknesses of hollow cylinders, cones, and other more complex parts with surfaces of revolution can be checked at as many reference points as desired under tape control on a Pratt & Whitney 6-co-ordinate inspection machine. Each gauging head has horizontal, vertical and rotary movement, and the digital read out can be stored, recorded, or mathematically processed.

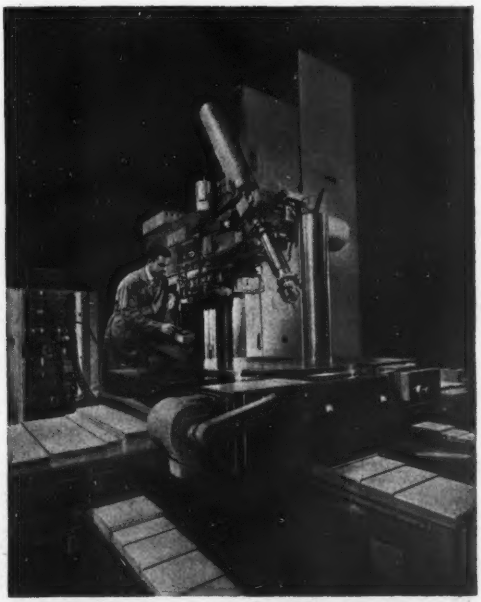


Fig. 1. Pratt & Whitney 8-axis, numerically-controlled, precision measuring machine

Reference may also be made to the Pratt & Whitney Unicomm multiple-gauge contour measuing machine, which is not numerically-controlled, but provides a punched-tape record of inspection results. This special equipment has been designed to gauge both the inside and outside surfaces of parts having cylindrical or complex surfaces of revolution, such as missile nose cones. The thickness is also measured. The electric gauge units are carried on two supporting arms at positions where close tolerances must be held on the workpiece, and the latter is rotated continuously, or automatically indexed, in accordance with the pre-determined inspection procedure. The supporting arms are pivoted, and the gauges are brought into contact with master templates for zero setting.

The company has recently developed a special automatic gauging device with digital punched card read-out, for checking channel-shaped fuel elements for a nuclear reactor. Nine readings are required to be taken on the cross-section of the element at 45 different positions along the length, the total of 405 dimensions being recorded on punched cards. These data are then used as a permanent record for size comparison, to enable the design of the fuel elements to be improved.

Error-compensating cams for azimuth indicator rotary tables concerned with the aiming of guided missiles, are made on a numerically-controlled Pratt & Whitney Keller machine that is programmed directly from digital design data. The cams are machined without preparing a drawing, since the design data being computed from inspection results obtained in measuring the errors existing at each degree setting of the rotary table on which the cam is to be employed. These cams are used to provide electrical compensation for the physical errors present in the particular table. In this way, an azimuth indicator table was improved from an accuracy of ± 7 sec. of arc, to 1·75 sec. of arc.

The sole agents in this country for Pratt & Whitney Co., Inc. are Buck & Hickman, Ltd., Otterspool Way, Watford By-Pass, Watford, Herts., except for Keller machines, which are handled by Alfred Herbert, Ltd., Coventry.

Fig. 2. The quill of the Pratt & Whitney measuring machine is set to the required angle under push-button control

Pyrene Automatic Fire Detecting and Alarm System

The Pyrene Co., Ltd., 9 Grosvenor Gardens, London, S.W.1, have introduced a fire detecting and alarm system which utilizes open-circuit detector heads installed in a two-wire system to provide continuous circuit supervision. In the event of a fire, one or more of the detector heads placed at suitable positions throughout a building will register the sudden rise in ambient temperature.

With the aid of a special indicating cabinet, warning of the outbreak, and information regarding its location, is automatically transmitted to the company's fire report centre, and, if desired, can also be relayed by way of a G.P.O. cable to the control room on the premises of the nearest fire brigade.

Two types of detector heads are available. The combined rate-of-rise and fixed temperature head usually employed incorporates a twin bimetallic element. Alternatively, there is a fixed temperature head which depends upon the fusion of a low melting-point alloy at a pre-determined temperature.

The system is energized by a power supply unit which is connected to the electricity mains, and a maximum of 22 zone indicating units can be used with one power supply unit. In the event of a power cut, an emergency supply is automatically provided from batteries by a separate panel. This Pyrene fire detection and alarm system, it is stated, has been fully approved by the Fire Offices' Committee.

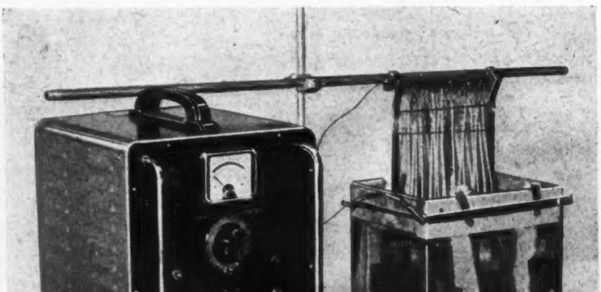
The Application of Ultrasonics to Electroplating Processes*

By B. BROWN, B.Sc., Ph.D.

The application of ultrasonic energy to electroplating processes led initially to some rather exaggerated claims, but continued research by workers in the U.S.A. and Germany, both in the laboratory and with pilot plants, has led to the conclusion that there are definite advantages to be gained.

It is well known that gas bubbles forming at electrode faces have an important influence in electroplating. These bubbles can, in fact, eventually lead to a depletion of the diffusion layer of ions between electrode and electrolyte, which ordinarily limits the current yield. The application of ultrasonic energy to the electrolyte results in high accelerations being imparted to the solution, and in cavitation, particularly at the liquid-solid interfaces. The resulting agitation imparted to the solution counteracts the depletion of the diffusion layer of ions, with the result that anode polarization and cathode starvation are virtually eliminated, so that plating speeds are considerably increased.

* From an article published in the Dawe Digest, June 1961, Vol. 4, No. 2, of Dawe Instruments Ltd., Western Ave., Acton, London, W.3.



A Dawe generator and immersible transducer used for trials to determine the effects of ultrasonic depolarization of plating bath electrodes by I.D.M. Electronics, Ltd.

It is also possible that abrasion of the electrode surface by cavitation takes place, resulting in the removal of absorbed materials which might otherwise reduce the active surface area, but definite conclusions have not yet been reached on this point. It has, however, been found possible to plate parts under conditions of such high contamination that plating would normally be impossible. Apparently, therefore, the well-known cleaning action of ultrasonics also plays an important part in the process.

Intensity of cavitation increases as the ultrasonic frequency is reduced, and for this reason it is usual to employ frequencies in the 20-40 kc/s. range. An upper limit is imposed on the ultrasonic intensity that can be used successfully, since at energy concentrations higher than 1 watt per sq. cm. metal particles appear in suspension, probably due to cavitational erosion of the plating.

Structural characteristics of deposited metals are modified by ultrasonic action during electrodeposition. It has been found, for instance, that higher current densities can be used, with an improved distribution of the coating, in contrast to the poor throw normally expected with high currents. It has also been shown that the coatings can be produced in purer form, with higher tensile strength and hardness.

Ultrasonics have been successfully applied to the electrodeposition of many metals. In nickel plating it was found that with ultrasonic agitation the temperature requirements for the bath were far less stringent than is usual. An increase of current density of two to five times was possible, without burning, with a corresponding increase in the rate of deposition. Whereas normally a fall in plating current, due to polarization, occurs after a few minutes, depolarization produced by the ultrasonic vibration resulted in an increase in current flow.

It is necessary to avoid the use of

additives of high molecular weight in bright nickel baths, since the ultrasonic energy tends to break down such materials. This disadvantage has been overcome, however, by the development of additives of low molecular weight which are stable under the action of ultrasonics. The use of ultrasonics in nickel plating stainless steel has enabled the coating to be obtained more rapidly, but it has not permitted the pre-cleaning process to be eliminated.

Application of ultrasonics to chromium plating has produced promising results in some respects but not in others. High current densities have been used without burning, but improvements in throwing power and coating distribution have not been achieved. Ultrasonics have also been applied to barrel zinc plating, and pilot-scale experiments have indicated that it is possible to speed up the process considerably. When depositing zinc from cyanide baths, ultrasonics are also beneficial where surfaces have not been adequately pre-treated.

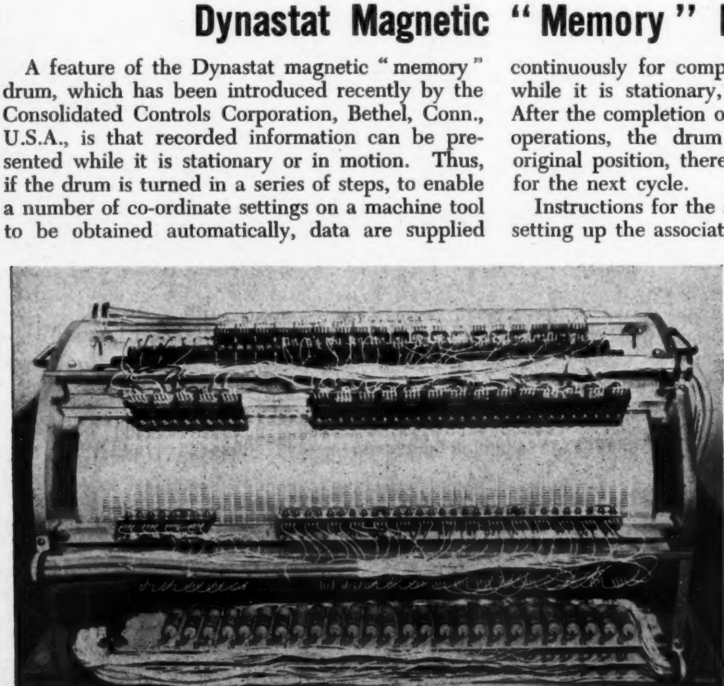
Higher current densities and faster rates of deposition are obtained when ultrasonics are applied to cyanide silver plating. In this application, however, it was found that at ordinary current densities adhesion of the plate deteriorates. Consequently, under these conditions it would appear that the use of ultrasonics would be limited to heavy silver plating.

Recently, I.D.M. Electronics, Ltd., Reading, Berks., have applied ultrasonics in connection with the gold-plating commutators and slip-rings. As in other applications already noted, the ensuing agitation reduces the insulating barrier formed round the component, resulting in improvement of the finished product. For this work, the ultrasonic equipment first used was a type 1150, 500 W/125 W generator, with a type 1161/B36 immersible transducer supplied by Dawe Instruments. Ltd., Western Avenue, Acton, London, W.3, and these two units are shown in the accompanying illustration.

Dynastat Magnetic "Memory" Drum

A feature of the Dynastat magnetic "memory" drum, which has been introduced recently by the Consolidated Controls Corporation, Bethel, Conn., U.S.A., is that recorded information can be presented while it is stationary or in motion. Thus, if the drum is turned in a series of steps, to enable a number of co-ordinate settings on a machine tool to be obtained automatically, data are supplied continuously for comparison and control purposes while it is stationary, during each cutting stage. After the completion of the sequence of machining operations, the drum is turned rapidly to the original position, thereby re-setting it in readiness for the next cycle.

Instructions for the sequence are recorded when setting up the associated machine, and co-ordinate data are supplied in the form of parallel binary code words. It is stated that the electrical output obtained is such that the need for sensitive amplifiers is obviated. The size of the drum varies according to the amount of information to be stored.



Dynastat magnetic "memory" drum provides for presentation of recorded information while the drum is stationary or in motion

As an example, it may be noted that a unit which incorporates a 10-channel, 2,000-bit drum, together with the associated heads, electronic equipment, and a terminal board, measures 26 by 14 by 14 in. A typical unit is shown in the accompanying illustration.

Set-up for Producing a Safety Razor Component on a Multi-spindle Automatic

By F. BRANSTROM*

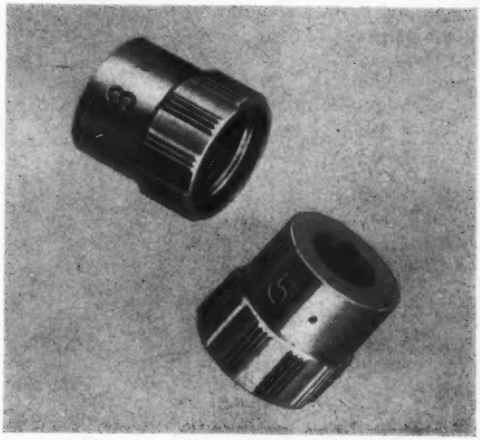


Fig. 1. This safety-razor component, which requires 13 operations, is produced in 4·5 sec. on a $\frac{9}{16}$-in. Acme-Gridley 6-spindle automatic

A SAFETY-RAZOR component, as shown in Fig. 1, which requires a total of 13 operations, including number rolling, knurling and "broaching," is being machined complete at one set-up on a $\frac{9}{16}$-in. Acme-Gridley, 6-spindle, bar automatic. It is produced from $\frac{5}{8}$-in., free-cutting, brass bar, which is specially heat-treated to facilitate rolling operations, in a cycle time of 4·5 sec. At 100 per cent efficiency, this cycle time gives an output of 800 pieces per hour, and with reasonable care, a net production of 600 pieces per hour is consistently obtained. A spindle speed of 2,140 r.p.m. is employed, and the corresponding cutting speed for the majority of the operations is 300 ft. per min.

The bar material is fed to an automatic stop at the sixth position, and the outside diameters are turned to a tolerance of 0·001 in. with a circular form tool tipped with tungsten carbide. This tolerance, it may be noted, is necessary to enable the subsequent operations to be performed correctly. In addition, a $\frac{3}{8}$-in. diameter hole is drilled part-way through the component at this position. Next, at the first spindle position, the numbers are impressed on the surface with a roll of three times the work diameter. This roll is advanced by a 25-deg. cross-slide cam and is in contact for three revolutions of the work spindle. Drive is transmitted to the roll through a spline shaft at one-third of the spindle speed. A drill is also applied at this station to produce a $\frac{1}{4}$-in. hole through the remaining length of the component.

Knurling is carried out at the second position, again with a tool of three times the work diameter, which is driven at one-third of the spindle

* National Acme Co., U.S.A.

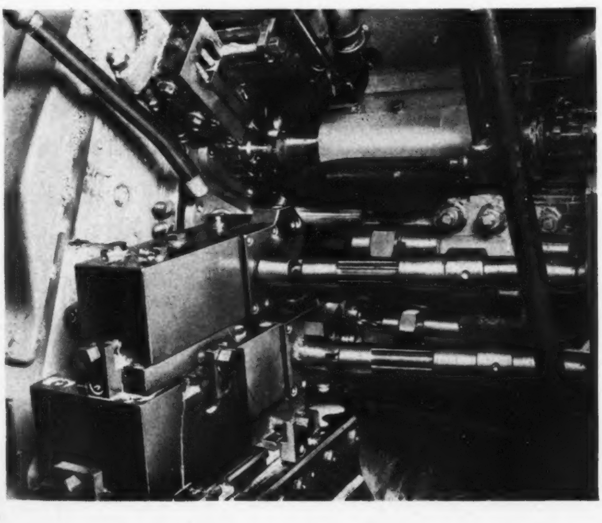


Fig. 2. A view of the set-up for producing the component in Fig. 1. The number rolling and knurling attachments, which are accurately synchronized with the work spindles, are mounted one above the other on the first-position cross-slide

speed, and at the same time a rough counterboring operation is performed. As may be seen in Fig. 2, the number rolling and knurling attachments are mounted one above the other on the first position cross-slide. It is necessary that the drives to these attachments should be synchronized with those of the work spindles within 0·1 deg.

For the broaching operation, at the third position, a hydraulically operated attachment, mounted on an independent cross-slide is advanced and retracted to cut away four of each seven lands formed by the knurl. As seen in Fig. 1, evenly spaced groups of three lands are left round the periphery of the workpiece. At the same time, a V-slot is broached internally, opposite the numeral 5. The hydraulic operation of the broach is controlled by trip cams on the front drum of the main camshaft, and accurate synchronization with the work rotation is again ensured.

At the fourth position, the component is shaved and any burrs formed during the knurling and broaching stages are removed. In addition, the hole is reamed and counterbored with a 3-step tool. These operations ensure the required high finish on the surfaces. Particular importance is attached to the finish of the portion in which the numbers are impressed, to permit automatic filling and wiping, after the component has been plated.

The sequence of operations is completed by tapping and parting-off at the fifth position, and the parts fall down a chute into a container.

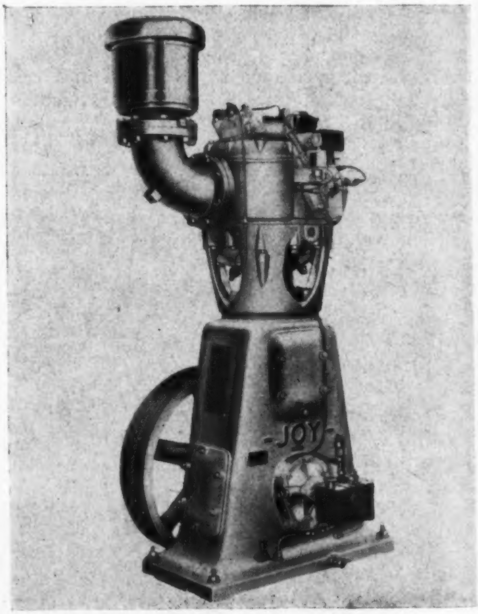
Joy-Sullivan Type WG-9 Heavy-duty Industrial Air Compressors

A new range of heavy-duty air compressors of compact vertical design has been introduced by the Air Power Division of Joy-Sullivan, Ltd., Cappielow, Greenock, Scotland. Known as the type WG-9, these compressors are single-cylinder, single-stage, water-cooled units, and are available in six sizes with capacities ranging from 75 to 334 cu. ft. of free air per min., at working pressures from 15 to 150 lb. per sq. in.

An example from the range is shown in the accompanying illustration, and it may be noted that the largest of these compressors, which has a bore of 11¼ in. and a stroke of 9 in., occupies a floor space of only 3 ft. by 3 ft. 5 in., without the driving motor. A type WGO-9 range of compressors, designed to deliver completely oil-free air, is also available.

Each compressor is normally arranged for Poly-Vee belt drive, but can be arranged for multiple V-belt drive if required. Alternatively, it can be supplied for coupling directly, or through a gearbox, to a diesel engine. The cast-iron cylinder is mounted on a heavy cast iron frame and is fitted with a honed liner of special alloy iron. An aluminium-alloy piston of truncated design has enabled the valves to be located at an angle in the cylinder head, and it is stated that this arrangement ensures improved heat transfer, better air flow, and extended valve life.

The crosshead, of Meehanite iron, is of one-piece, box form, and is tinned on the bearing surfaces to ensure rapid running-in. The crosshead guide, which is replaceable, is made from special alloy iron, and honed to a high surface



An example from the Joy-Sullivan WG-9 range of industrial air compressors

finish. A steel-backed bearing is fitted in the big-end of the drop-forged steel connecting rod, and heavy-duty, self-aligning ball bearings are provided for the crankshaft.

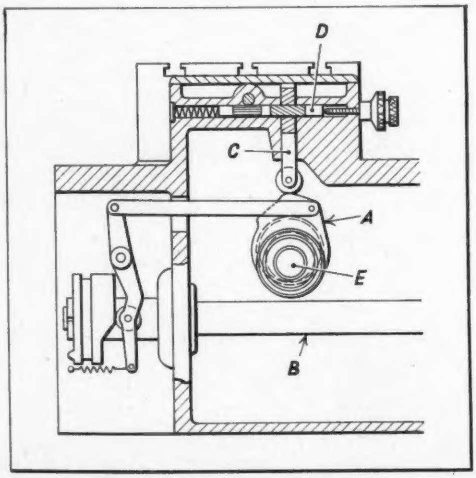
The standard regulation control incorporated is designed for conditions in which air demand is steady, and approaches maximum compressor capacity. Unloading is effected automatically by control of the inlet valve, and is governed by a pilot system according to demand. An alternative, dual-control, system can be provided for applications where air demand is intermittent.

Machine Shop Patents

FEED ARRANGEMENT FOR A THREADING LATHE

With the arrangement shown in the accompanying sectional view, automatic movement of the tool slide on a threading lathe towards and away from the work, prior to and after the completion of each cutting stroke, is applied by means of the cam *A*, which is housed in the saddle. This cam is alternately swung in the clockwise and anti-clockwise directions, the motion being derived from a face cam secured to the end of the main shaft *B*, by way of a follower lever and a connecting link. The shaft *B* is mounted in the saddle, and is turned continuously at a rate of 1 rev. per cutting stroke.

When the cam *A* is operated, the follower plunger *C* is moved vertically, and the motion is transmitted through rack teeth to rotate the longitudinal shaft *D*, which has meshing pinion teeth. A further set of pinion teeth on this shaft is in mesh with rack teeth on a lateral plunger, whereby motion is transmitted to the tool slide, which is spring-loaded away from the work. It may be noted that the first set of meshing rack and pinion teeth are of helical form, and with this arrangement, axial adjustment of the shaft *D* by means of a micrometer screw, against the thrust applied by a compression spring at the opposite end, provides for adjustment of the tool slide.



Sectional view of an arrangement for automatically engaging and disengaging the cutting tool, and applying increments of in-feed, on a threading lathe

To enable increments of in-feed to be applied, the bearing on which the cam *A* is mounted is secured eccentrically on the shaft *E*, which is turned through small angles, for successive cutting cycles, by means of a further cam on the main shaft *B*, for example.

870,837. Cri-Dan, S.A., 21 rue de la Paix, Paris (Seine), France. *[Application date in France, December 20, 1957. Published, June 21, 1961.]*

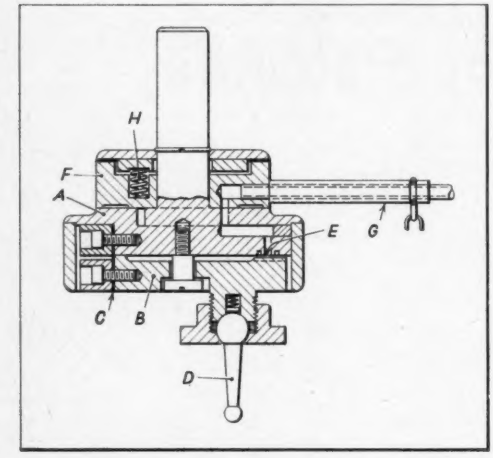
CENTRE-LOCATING INSTRUMENT

The figure overleaf shows a view of an instrument for locating the centre of holes, for example, in a workpiece on a jig boring or grinding machine.

Provided with a shank for attachment to the spindle of the machine, the body *A* has a diametral slot in the face of the flange at the lower end, in which the arm *B* is housed with small side clearance. This arm is pivotally mounted, for sensitive movement in directions parallel to the axis of the instrument, by a leaf spring *C*, secured to the left-hand end, and the corresponding face of a recess in the body, by segmentally-shaped blocks and screws. By means of a knurled nut, the ball-ended stylus *D* is clamped against a threaded projection close to the opposite end of the arm, and can be swung to various angular positions.

In operation, the arm *B* is deflected when the stylus contacts a surface of the work, thus altering the gap between an upper surface close to the right-hand end and the orifice *E* in the body, from which compressed air escapes. The resultant change of back pressure in the system by which air is supplied to the orifice serves to alter the height of a column of fluid in a remote indicating instrument.

The arrangement for supplying compressed air to the orifice includes the collar *F*, which is located by the shank of the body and is prevented from turning when the instrument is in use by securing the hollow arm *G* to a convenient part of the machine. Air passes along this arm, and is then directed by a vertical passage in the collar to an annular groove in the upper face of the body flange. Drilled passages connect this groove with



Sectional view of an instrument for locating the centres of holes, for example, in a workpiece on a jig boring or grinding machine

the orifice. To restrict escape of air between the collar and the body, the former is urged downwards by compression springs, as at *H*, the upper ends of which are seated in pockets in a separate ring. Upward movement of this ring is prevented by a cover ring, which is retained by a circlip on the body shank, and two vertical pins ensure that it does not turn independently of the collar. An annular recess in the lower end of the latter serves to collect any escaping air, which is then directed by vents to the atmosphere, so that pressure is not exerted to force the members apart.

872,064. The Sheffield Corp., Dayton, Ohio, U.S.A. *[Application date in U.S.A., April 3, 1958. Published July 5, 1961.]*

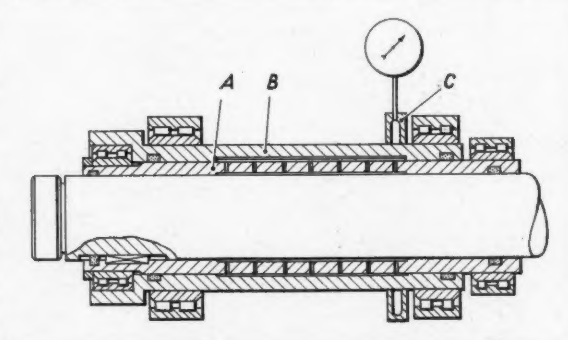
CUTTER SPINDLE MOUNTING ARRANGEMENT

The accompanying sectional drawing shows a mounting arrangement for the cutter spindle of a milling or drilling machine, which is designed to damp radial vibration.

Arranged for axial movement independently, the spindle is mounted in the inner sleeve *A*, and the bearings at the ends of this sleeve are housed separately in the machine head and the outer sleeve *B*. Bearings for the outer sleeve are housed in the head, and are spaced between those for the inner sleeve. Drive for the spindle is transmitted from the inner sleeve by means of a key, which engages a long keyway.

For vibration damping, pressure fluid is delivered to the assembly by way of the manifold ring *C* surrounding the outer sleeve, and passes through a radial hole in the latter, to enter a shallow annular recess, which entends along the bore and is spaced between the bearings. A longitudinal groove ensures the uniform distribution of fluid over the entire length of the space which is thus formed around the inner sleeve. By way of a number of radial holes, fluid is thence supplied to a similar annular space around the spindle, which is thus kept continuously filled despite any losses by leakage.

It will be readily apparent that fluid must be displaced rapidly from this space to permit radial vibration of the spindle, but such flow is restricted since the supply passages by which it must pass are of small diameter.



Sectional view of a cutter spindle mounting arrangement which provides for damping radial-vibration

872,021. Vereinigte Werkzeugmaschinenfabriken Aktiengesellschaft, Frankfurt-am-Main, Germany. *[Application date in Germany, July 26, 1958. Published July 5, 1961.]*

PRODUCTION OF TRACTORS. During the first three months of this year, a total of 52,476 agricultural and industrial wheeled tractors, and 18,758 market garden tractors were built in the U.K. For the corresponding period of last year, the number of agricultural and industrial wheeled tractors built was 53,428, and of market garden tractors, 13,376.

Factors Affecting the Choice of Inserted-blade or Throw-away Tip Milling Cutters

By F. GABLE*

BECAUSE THE MAJORITY of milling operations can be performed by either inserted-blade cutters that can be sharpened, or with throw-away tip cutters, a study of current practices in industry was made by the Wesson Co., Ferndale, Mich., U.S.A., to ascertain what factors determine the choice of one type of cutter rather than the other for a particular application. This company, it may be noted, makes both types of cutters.

Of the works investigated, 95 per cent used throw-away tip face-milling cutters for either finishing or roughing, or both, although hitherto most cutters of this type have been employed for roughing operations. No company in the survey, however, used throw-away tip cutters for more than half the rough milling operations performed.

* Wesson Co., U.S.A.

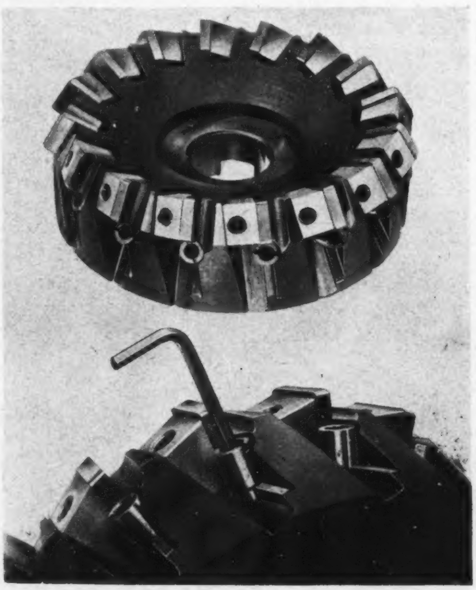


Fig. 1. Wesson throw-away tip milling cutter with provison for individual axial adjustment of the blades

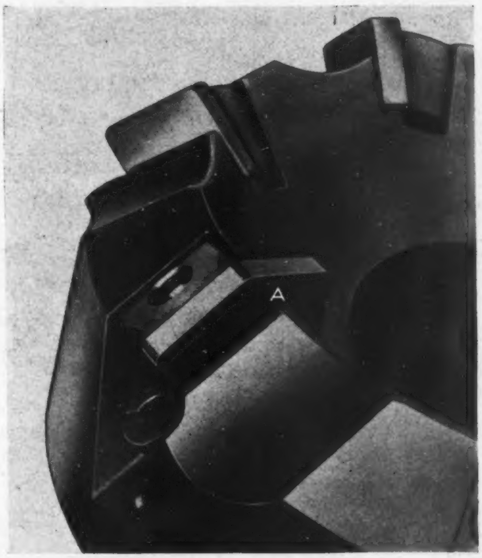


Fig. 2. The use of a micro-finishing insert *A*, in a throw-away tip cutter, enables fine finishes to be obtained at comparatively high feed rates

There is no basic difference between the chip removal capabilities of inserted-blade and throw-away tip cutters, with the same numbers of blades and operating at the same surface speed. For thin-walled workpieces, however, or where for other reasons a lower chip load per tooth is desirable to reduce cutting forces, inserted blade cutters have the advantage of providing longer cutting edges and offer the possibility of employing more teeth for a given diameter of cutter. The latter advantage is, however, somewhat reduced by the latest designs of cutter bodies to take throw-away tips. On the other hand, the provision of the greatest possible number of teeth in a cutter is not always an advantage, and limitations imposed by the power of the machine, and the nature of the operation, may necessitate the use of fewer blades.

Until recently, the accuracy of a cutter fitted

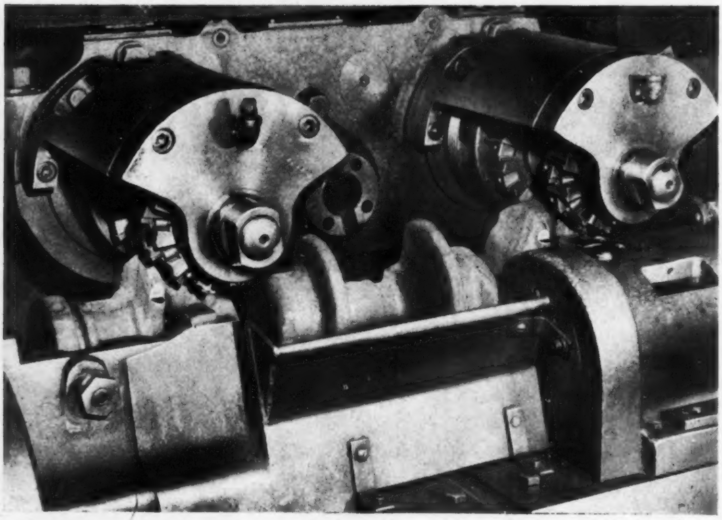


Fig. 3. **With this crankshaft milling set-up the throw-away tips are indexed while the cutters are mounted on the machine. In the first year of operation, savings exceeded the initial cost of the cutters**

with throw-away tips was limited to the commercial tolerances to which the tips were produced. There have been several developments, however, which have enabled the cutters to be successfully employed for finishing. In Fig. 1, for example, is shown a design of cutter which incorporates square, throw-away tips. Each tip is secured by a locking wedge, and is backed up in the axial direction by a pin. This pin has a tapered inner portion which is secured in the cutter body by a differential screw, and an upper portion with a constant-rise cam form of 0·030-in. maximum throw. Accurate axial adjustment of a blade can be obtained by releasing the locking wedge and the differential screw, and then turning the pin.

By careful setting of the blaaes, it is possible to produce finishes smootner than 60 micro-inches. Further improvements in surface finish can be obtained with this type of cutter by replacing one of the standard throw - away tips with a micro-finishing tip as shown at *A* in Fig. 2. This insert is provided with a cutting edge which is longer than the increment of feed per revolution, and it thus serves as a wiper blade.

When equipping a new plant, it is generally preferable to provide for the use of throw-away tipped cutters, since the cost of grinding, and the overhead costs associated with a grinding department are eliminated. Moreover, the blades can be mounted in the cutter by the operator, at the machine, and the number of cutters required is consequently reduced. In addition, the

Fig. 4. **Threaded adapters for inserted blade face-milling cutters which facilitate adjustment**

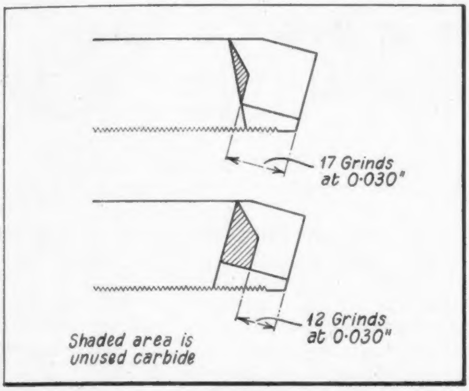


Fig. 5. The new design of inserted blade, shown above, can be reground more often, and there is less waste of carbide

tips can often be used for turning and boring, as well as for milling operations. In plants where the equipment is already available, it is sometimes the practice to lap throw-away tips after all the cutting edges have been used. These lapped inserts can be employed again in milling cutters, or for other machining operations. It is highly doubtful, however, whether the savings which can be obtained in this way would justify capital investment in lapping equipment, in view of the low cost of new inserts.

In Fig. 3 is shown a set-up for milling location faces on motor-car crankshaft forgings, for which brazed-tip, inserted-blade cutters were originally employed. Because of high grinding and setting up costs, it was decided to change over to throw-away tips. An initial expenditure of about £1,400 was required on 12 cutter bodies, the saving during the first year, due to the reduction in tool costs and grinding time, and the greater number of pieces obtained per cutting edge, was £2,200 for an output of 170,000 crankshafts.

Considerable reductions in set-up times can also be achieved with inserted-blade cutters, however, if adjustable, threaded adapters, as shown in Fig. 4, are employed. With such an adapter, it may be possible to sharpen a face-milling cutter four times before the blades must be re-set, assuming that 0·020 in. is removed per regrind. In this connection, reference may be made to a set-up on a transfer machine, where the overall length of the workpiece must be held to ±0·004 in. Here, the axial positions of the cutters are adjusted more rapidly by means of the adapters than by re-setting the hydraulic feed units.

It should also be pointed out that the shape of a brazed tip can have an important bearing on the economical use of tungsten carbide, as indicated in Fig. 5. Here, the shaded area represents unused carbide, and it will be noted that by a slight alteration of form, the number of regrinds obtainable has been increased from 12 to 17.

The opinion is frequently held that only double-negative rake angles can be used with throw-away tip milling cutters. Tests on actual production parts, however, have shown that double positive, and combination positive-negative rake angles can be used effectively to direct chip flow, and avoid excessive cutting forces on both workpieces and fixtures. If the operation to be performed is unusual, the correct tool geometry can be determined more readily with inserted-blade cutters which can be ground experimentally to various angles. As an alternative, throw-away cartridge-type cutters, which are available in a range of standard angles, can be employed. Although these cutters are relatively expensive, they can be used for long periods for test purposes.

Moore & Wright No. 808 Screw Pitch Gauge

The No. 808 screw pitch gauge made by Moore & Wright (Sheffield), Ltd., Handsworth Road, Sheffield, 13, incorporates two sets of blades, which are pivotally mounted in a divided, open-sided steel case, as here shown, and comprise 30 for checking Unified threads from 4 to 42 per in., and 27 for Whitworth-form threads from 4 to 60 per in. An additional blade in the latter set provides for the inspection of the plan shape of single-point screw-cutting tools for this form. The gauging portions of the blades are accurately milled by means of thread ground hobs, and the rear edges are relieved, to enable internal threads to be checked.

Moore & Wright No. 808 screw pitch gauge

Roller Burnishing Operations on Motor Car Valves

By R. L. LEE, A.M.I.E.D., A.M.Inst.W.S.

It is often difficult to determine the precise reason for failure of a motor car engine valve merely by examining the component, but it has been established that there are certain contributory causes. In general, failure of a valve is caused, principally, by sticking of the stem within its guide because of radial expansion due to overheating; wear; scuffing of the bearing surfaces as a result of inadequate lubrication; and the building up of carbon deposits which reduce the clearance between the stem and the guide, result in an abrasive action, and cause a reduction in the dissipation of heat.

Since correct functioning of the valve in service depends upon the sliding action of the stem in its guide, it follows that a high degree of surface finish, to ensure high resistance to wear and the building up of carbon deposits, is required to provide for smooth operation even in the event of temporary absence of lubricant. Investigations have shown that when a valve is in service, stresses set up in the metal during various production operations, are released, and result in distortion of the stem. Although such distortion may not result in sticking, the sliding action will be obstructed, and consequent wear of the stem and the guide bore will lead to faulty seating of the head. Moreover, in the case of an inlet valve, lubricant from the bearing surfaces of the stem and guide will be drawn into the combustion chamber of the engine during the intake stroke of the piston.

In the production of poppet valves at the works of a well-known firm of motor car manufacturers in Germany, the stems are straightened by rotating spiral pressure rolls, following forming operations on the head, heat treatment, and shot blasting. Roller burnishing is then carried out on a Hegenscheidt machine, in which the stem is passed between a set of rolls. High pressure is applied to the stem during this operation, and it is claimed that as a result, stresses set up in the metal during previous operations are stabilized, and subsequent distortion of the valve in service is reduced. In addition, improved toughness of the metal at the surface of the stem is obtained as a result of cold working, and since a high degree of accuracy for straightness is ensured, the amount of metal required for subsequent centreless grinding is reduced.

When centreless grinding and other operations have been completed on the valve, a roller superfinishing operation is carried out on the stem on another Hegenscheidt machine, which is generally similar to that employed for burnishing, and was described in MACHINERY, 98/386—15/2/61. A surface finish of 2 micro-inches is obtained during roller burnishing, which imparts a high resistance to wear, and reduces the risk of carbon deposits being built up on the stem when the valve is in service. A total of four machines is employed for this operation, each of which will handle valves at the rate of 12 per min.

As was mentioned in the earlier article, each machine incorporates two superfinishing rolls and a single, larger-diameter, driving roll, mounted in an inclined head. Valves to be superfinished are loaded on to inclined guide rails at the rear of the machine, down which they pass by gravity, to be delivered, one at a time, to the rolling position by way of a solenoid-operated escape mechanism. The driving roll is now advanced to apply a force of 4,200 lb. to the valve stem. Since the driving roll is set at an angle to the superfinishing rolls, a through-feed motion is imparted to the valve during the working cycle. When superfinishing has been completed, the valve operates a micro-switch to return the driving roll to its original position, and is then discharged by gravity and passes down a chute at the front of the machine.

Elgar Machine Tool Co., Ltd., 172-178 Victoria Road, London, W.3, are the sole agents in this country for Hegenscheidt roller burnishing machines.

SMALL-BORE GLASS FIBRE TUBING. Small-bore glass fibre tubing in long lengths is now available in three sizes of ¼-, ⅜-, and ½-in. bore, with a $\frac{1}{16}$-in. wall thickness. This tubing is being produced, by a patented continuous process, by Fibre-Glass Tubes (Isle-of-Man), Ltd., Kensington House, Rosemount, Douglas, Isle-of-Man, and for ease of transportation is usually made in lengths from 10 to 20 ft. It is stated that this tubing is practically inert chemically, and has good tensile and dielectric strength. When experimental work has been completed, the glass fibre tube will also be available in larger sizes.

NEW PRODUCTION EQUIPMENT

Edited by
G. W. Mason
and
A. J. Barker

Lodge & Shipley Floturn No. 12 Horizontal Flow-turning Machine

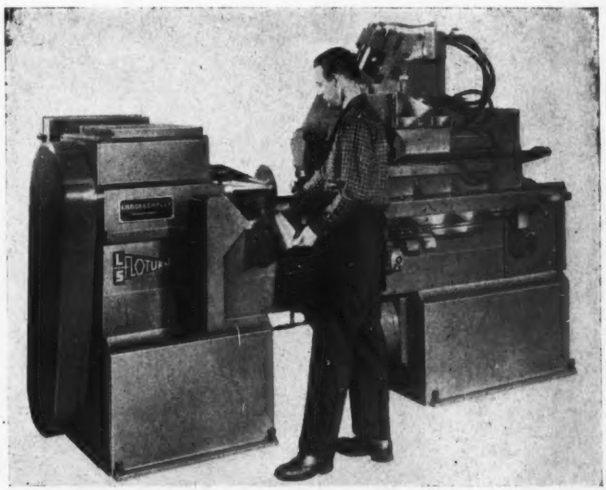
The Floturn No. 12 horizontal flow-turning machine seen in the figure has been introduced recently by the Lodge & Shipley Co., Cincinnati, Ohio, U.S.A. Blanks up to 18 in. diameter and 12 in. square can be accommodated, and the maximum length of the completed workpiece is 15 in.

The machine operates on the same principle as the company's earlier Floturn lathes, and the working cycle is automatic. If required, it can be employed in conjunction with automatic loading and unloading equipment. Forming is carried out with a single roller, the housing for which can be set so that the roller face is at an angle of 75 or 15 deg. to the work axis. This housing is mounted above the work, on a slide which is inclined upwards at an angle of 60 deg. towards the right-hand end of the machine, and is traversed hydraulically along ways on a saddle. Carried on ways at the right-hand end of the bed, this saddle is operated by a hydraulic cylinder which provides a net feed thrust of 4,000 lb., and movement of the roller slide is controlled by a hydraulic copying system, from a flat template. Vertical adjustment is provided for the tracer head, and an arrangement is incorporated whereby compensation is made automatically for variations in the thickness of the blanks. If required, a tool-holder can be supplied for attachment in place of the roller housing, for copy-turning mandrels.

Drive for the headstock spindle is taken from a 15-h.p. Dinabrake motor, and is normally transmitted through a V-belt system, whereby 8 speeds, from 403 to 1,611 r.p.m., are obtained by the use of interchangeable pulleys. Alternatively, a unit can be provided to enable the speed to be steplessly varied over this range. The spindle has an American standard B-1 nose, and it runs in adjustable bearings, which are pre-set for the highest speed obtainable. A double-row roller bearing is employed at the nose end, for absorbing radial loads, and two opposed taper roller bearings at the rear. A hydraulic centring arrangement is incorporated, for locating the work-piece blank, and with the latter in position, the operating cycle is started by means of a lever.

The work blank is then clamped to the mandrel by a ram, which carries a live centre, and the centring arrangement is retracted. Valves controlling the saddle and the roller slide are next operated, and the saddle is traversed rapidly towards the headstock.

At a pre-determined stage, rapid traverse is disengaged and feed applied, and the spindle drive is engaged, in readiness for the forming operation. Feed rates from 0·4 to 72 and up to 40 in. per min. are obtainable for the saddle and the roller slide, respectively, and while forming is in progress, the clamping ram is automatically adjusted, to compensate for movement of the



Lodge & Shipley Floturn No. 12 horizontal flow-turning machine

saddle and maintain a constant force of 2,000 lb. on the workpiece. When forming has been completed, the saddle and the roller slide are rapidly returned to the original positions, and the clamping ram is retracted. If required, a stripper unit can be mounted on the side of the headstock, which is machined, and brought into operation automatically, to withdraw the finished part from the mandrel.

Pressure oil for operating the roller slide and the other moving members is drawn from a 43-gal. tank by separate 3-h.p. motor-driven pumps, and the hydraulic equipment is housed in the right-hand pedestal. The machine measures approximately 10 ft. long by 4 ft. wide.

Kearney & Trecker-C.V.A., Ltd., Portland Road, Hove, Sussex, represent the Lodge & Shipley Co. in this country.

Besco TRP6/25 Pyramid Plate Bending Rollers

Designated TRP6/25, the machine shown below has been added to the Besco range of pyramid plate bending rollers built by F. J. Edwards, Ltd., 359-361 Euston Road, London, N.W.1, and has capacity for mild steel plates up to 6 ft. by ¼ in. It occupies floor space measuring 9 ft. 8 in. by 2 ft. 4 in.

The machine is of robust construction, and the two 6½-in. diameter bottom rolls, which run in fixed bearings, are arranged close together, to reduce to the minimum the width of the flats at the leading and trailing edges of the work. Drive to these rolls is taken from a 6-h.p. slip-ring motor through V-belt and single reduction worm gearing in the base, and is thence through spur gears. A joystick lever provides for selecting the direction of roll rotation.

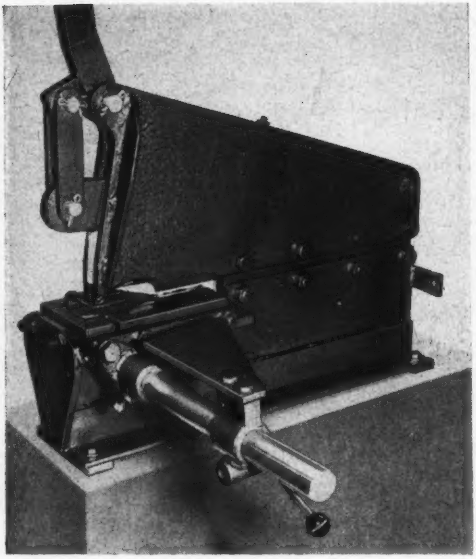
Besco TRP6/25 pyramid plate bending rollers

For altering the bending radius, the bearing blocks in which the 7½-in. diameter upper roll is carried are adjusted vertically, and drive for this movement is taken from a separate 2-h.p. motor, which is controlled by means of push-buttons. Adjustable stops are provided, to operate limit switches for disengaging the drive at pre-determined positions, and the transmission systems for both this roll and the bottom rolls incorporate magnetic brakes, to prevent over-run. A screw-operated support for the top roll, at the left-hand end of the machine, enables the work to be freed for removal after the completion of bending, and the bearing housing at the opposite end can then be swung downwards, to permit the withdrawal of closed cylinders. Interlocking is provided, to prevent the machine from being re-started until the support screw has been released.

"Ferrous" Type G.B. Bench-mounted Shearing Machine

In the figure is shown the type G.B. hand-operated shearing machine for bench mounting, which has recently been introduced by Ferrous Transformers, Ltd., Church Road, Croydon, Surrey. The subject of a patent application, this machine is intended for straight-line cutting operations, and will handle mild steel and stainless steel sheets up to ⅛ in. thick, and non-ferrous metals up to $\frac{3}{16}$ in. thick.

During the shearing operation, a narrow strip is cut from the work by a punch and die at each movement of the operating lever. With this arrangement, it is stated, distortion of the work by the shearing action is avoided. At the beginning of the shearing operation, a shallow notch—approximately ¼ in. deep—is cut at the edge of the work. When the punch has been raised to its full extent, the work is advanced to bring the notch into engagement with a projection at the rear end. The right-hand edge of the work is then brought into contact with a stop adjustably mounted on a cylindrical guide bar at the side of the base. Alternatively, the work may be adjusted until a line marked on the top surface is set coincident with the inner edge of a stripper piece, in readiness for taking the next cut. This procedure may be repeated, and the edges of the slot cut in the work pass on either side of the frame at the rear



Cuts of any length can be made in sheet metal workpieces, on this "Ferrous" type G.B. shearing machine

to permit cutting to be continued for any length.

In addition, the machine may be employed for cutting notches and slots of various lengths and widths in sheet metal workpieces. The die is open at the rear end, and is built up from three pieces, which can be ground individually for sharpening the cutting edges.

Corrosometer for Measuring the Rate of Corrosion of Metals

The Crest Instrument Co., Santa Fé Springs, California, U.S.A., are producing, under licence from the Standard Oil Co., Inc., the Corrosometer shown in the figure, which permits of rapidly measuring corrosion rates in the laboratory, and in process and storage plants. It can be operated from the mains or a battery, and a system of probes enables corrosion to be checked at a considerable number of points.

A probe comprises an exposed specimen of the material of which the pipe line, reaction chamber, storage tank, or laboratory specimen is made, a reference specimen, and a check specimen. The reading from the probe is given directly in micro-inches or cm. on the meter, and the instrument can be used for all metals and alloys. Each reading is obtained in less than one min., and is independent of the temperature of the plant.

The instrument determines the progress of corrosion of the metal specimen by measuring the increase in its electrical resistance as the cross section is reduced. A resistance ratio is then determined between the exposed specimen and the reference specimen of the same metal which is provided with a protective coating. A check specimen, also coated for protection, is compared, at regular intervals, with the reference specimen to ascertain that the protective coating of the latter is intact.

Connection is made between the probe and the instrument only at the time when a reading is being taken, and checks can be made while a plant is in operation. Once the probe is installed, it need not be removed, and if corrosion is carefully inhibited it can remain in place possibly for years. The Corrosometer may be installed in any convenient control room since several hundred feet of extension cable can be employed. Alternatively, it can be used as a portable instrument for taking readings regularly at probe points.

Probes of wire, tube or strip can be supplied, according to requirements, and they may range from one to 80 mm. in thickness. It is stated that more than 50 alloys are maintained in stock, from which a selection can be made to match a particular plant. Only 2 to 10 millivolts is applied to the probe and it is stated that the sensitivity of the

Corrosometer corrosion testing instrument

instrument is such that it will detect 0·1 micro-inch penetration of a strip 0·001 in. thick.

The sole agents for the Corrosometer in this country and the Commonwealth are Winston Electronics, Ltd., Govett Avenue, Shepperton, Middlesex.

Special Swift Centre Lathe

The lathe shown in Fig. 1 was recently designed and built by George Swift & Sons, Ltd., Claremount Works, Halifax, Yorks., a member company of the Asquith Machine Tool Corporation. It is based on the Swift 19C lathe, but has raised centres to provide a swing capacity of 48 in. diameter over the saddle, and admits 7 ft. between the centres. Hydraulic profiling equipment has been provided, to enable the complete external form of aero engine turbine casing components to be turned. These components have parallel and tapered sections, and some portions are of non-circular form. In production, two casing components are mounted on a mandrel which is secured to the spindle flange and supported by a built-in revolving tailstock centre, and are machined simultaneously. The mandrel also carries a master from which the profiling operations are controlled. The close-up view in Fig. 2 shows the mandrel in position on the machine with the master component at A.

The lathe headstock is driven from a 20-h.p. motor through a steplessly variable speed unit, which, in conjunction with 18 gear changes, provides an overall spindle speed range from 2·2 to 520 r.p.m. The 5:1 ratio variable speed unit can be operated manually from a control point on

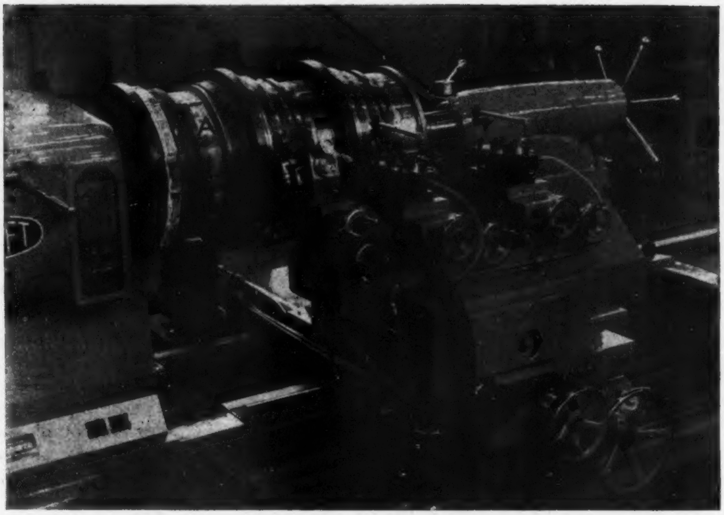


Fig. 2. Close-up view showing two turbine casing components mounted on a mandrel on the Swift lathe, also the master from which the form is controlled

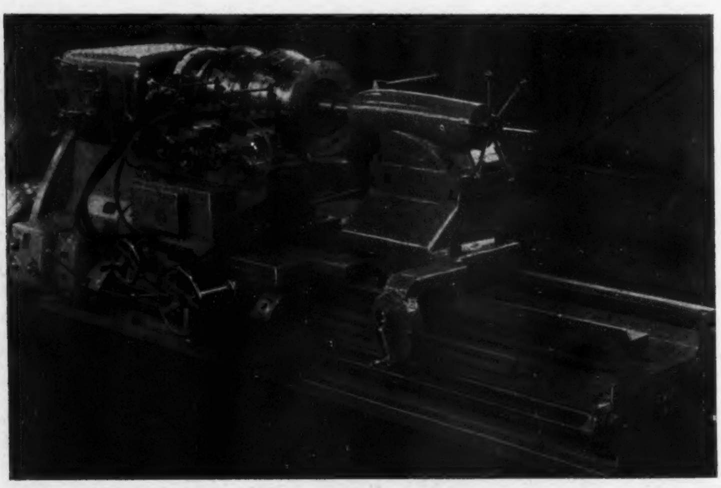


Fig. 1. Special Swift lathe with increased centre height and Hepworth hydraulic copying equipment, for turning operations on aero engine turbine casing components

the right-hand side of the saddle unit, or automatically to increase or decrease the spindle speed as the stylus travels over the circular and non-circular portions of the master. There are three slides on the saddle, one of which—on the left—carries the tracer unit, and the other two, cutting tools. Each slide has independent adjustment, and reversible power feeds to the saddle are provided by a 9-speed box, feed motion being engaged by a drop-worm operated by a lever at the front of the apron. All controls for the machine, apart from the mechanical speed and feed change levers, are grouped on the saddle.

A pump unit for the hydraulically-operated copying equipment is mounted at the rear of—and travels with—the saddle, to eliminate trailing pipes. This equipment, which was supplied by the Hepworth Iron Company (Engineering), Ltd., Hazelhead, Nr. Sheffield, was designed to ensure rapid response, to enable comparatively high cutting speeds to be employed when turning the non-circular portions of the components.

The machine weighs approximately 13½ tons.

Larrad Hydraulic Clamping Equipment

Reference has been made in previous articles in MACHINERY to hydraulic work-clamping equipment made by Larrad (Hydrajaws), Ltd., 61 Queen's Road, Coventry, which is now distributed by Alfred Herbert, Ltd., Coventry. With each unit in the range, clamping pressure is applied to the work at a number of points, by means of plungers that are mounted in individual bores in a body member. Pressure is applied to the plungers by hydraulic fluid, and the bores are inter-connected, to ensure

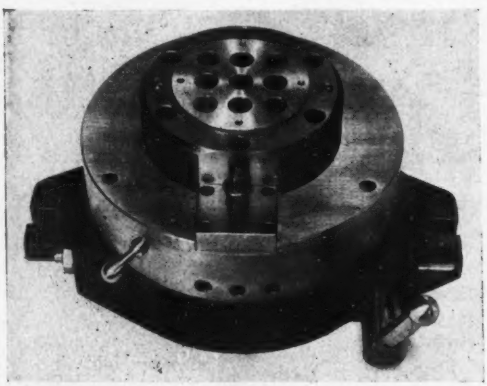


Fig. 1. This standard Larrad hydraulic clamping fixture holds nine components, and has an indexing movement of 90 deg.

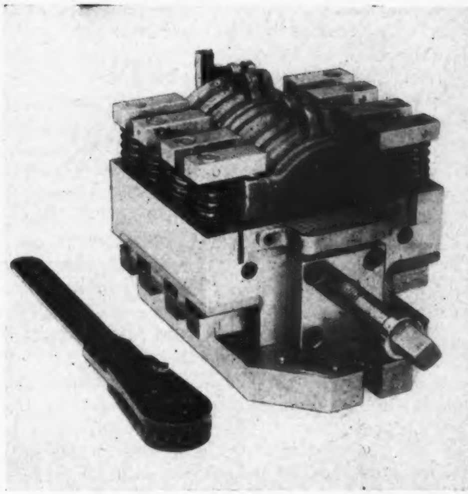


Fig. 2. In this special Larrad fixture, four bearing caps are clamped by the downward movement of arms at both sides. The caps are located on a removable plate, to facilitate unloading and loading operations

that uniform clamping pressure is applied at all points regardless of the shape of the work. If required, moreover, a number of workpieces which vary slightly from a nominal size, due to manufacturing tolerances, can sometimes be effectively clamped simultaneously.

The standard range includes eight hydraulic vice jaws, of various sizes, and the plunger ends may be conical, plain, flat, flat with a machined diamond pattern, spherical, or of shallow V-form, or be provided with brass or fibre tips. For use with the smaller jaws, matching blocks can be supplied which have multiple V-grooves, to enable a number of small parts to be held vertically, also blocks with single horizontal V-grooves. A series of six Hydrajaw clamps is available, for use on jigs or fixtures, for example, and the row of hydraulically-connected plungers which is provided in each unit, for applying thrust to the work, obviates the need for special arrangements to compensate for variation of workpiece size. With these units, the clamping pressure is automatically applied by the plungers when the vice or work-holding member of the fixture is tightened in the normal manner.

Developed from the equipment mentioned above, a variety of units is now being made, with each of which clamping force is obtained by displacing a quantity of hydraulic fluid by the

operation of a screw, and in this connection, reference may be made to the Planer Hydrajaw spiking-down clamp.

A range of standard fixtures is also available, and the example shown in Fig. 1 provides for holding nine workpieces, which are gripped in individual collets, and has an indexing movement of 90 deg., to facilitate such operations as milling square heads or cross slots. Interchangeable collets with capacities from ¼ to ⅝ in. diameter can be accommodated, and the entire set in use is closed with uniformly-distributed pressure by means of a single screw. The grip is maintained during indexing movements.

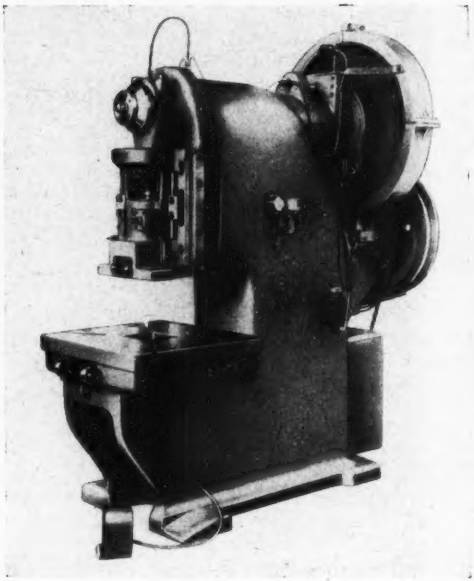
Fixtures are also designed and made for special purposes, and the unit seen in Fig. 2 provides for holding four semi-circular bearing caps while slots are line-milled through radial lugs projecting from the upper portions. On this fixture, there are clamping arms at both sides of the components, which are thrust downwards when the single screw is turned by means of the ratchet spanner at the left of the illustration. To ensure that the minimum of time is lost during unloading and loading, the work is located directly on a separate support plate, which is removed from the fixture, together with the set of parts, after machining has been completed. An identical plate, on which a fresh set of parts has been loaded, is then placed in the fixture.

Dansk Mechanical Presses

For the range of mechanical presses built by the Danish company of Dansk Pressfabrik, which comprises more than 80 geared and ungeared types, Soag Machine Tools, Ltd., Juxon Street, London, S.E.11, have recently been appointed sole distributors in this country.

Double-acting drawing and friction screw presses are included in the range, also the KD series of wide, straight-sided, eccentric presses of various capacities. Each of the latter machines is characterized by the wide spacing of the uprights, and the provision of two connecting rods for operating the ram, to provide for set-ups where the centre of the force applied to the work is offset considerably from the centre line of the slide. Extra equipment which can be supplied includes an air counterbalancing arrangement. Narrow versions of these straight-sided, eccentric presses are also available.

Inclinable open-fronted presses in the KE series can be set at angles up to 45 deg. from the vertical, and cover a range of sizes, with throat depths up to 13¾ in. On each of these presses, the main bearing for the eccentric shaft is split



Dansk KAHT 60/450, 60-ton, plain open-fronted eccentric press

in a plane which is inclined forward from the vertical, to ensure that the upward thrust during the pressing stroke is effectively transferred to the frame. The ram stroke may be of either standard or extended length, or adjustable, and a lever is provided whereby the machine may be set for continuous or single-stroke operation or for locking the transmission, and this arrangement, it may be noted, is provided on all the Dansk eccentric presses.

Drive is normally taken through a rolling key clutch, which transmits motion between the flywheel and the shaft in one direction only, but for use when a powerful die cushion is employed, a backing pawl can be supplied, whereby the two members are locked together, to permit the flywheel to absorb thrust during the return stroke and thus conserve energy. Alternatively, a multi-plate hydraulic clutch can be provided. On the heavier machines, a brake is applied automatically when the eccentric shaft reaches the top dead centre position, to prevent over-running. Other extra equipment which is available includes tie rods, a hydraulic brake, a hydraulic blank holder, roll and dial feed units, and an air ejection arrangement.

Designated KAHT 60/450, the 60-ton geared

machine, here shown, is typical of the KA series of plain open-fronted eccentric presses, and has a hydraulic clutch, which is supplied as extra equipment. Machines of this type are available with capacities up to 200 tons, and standard throat depths up to 17¾ in., also in ungeared form. The ram is carried in long ways, and the stroke length can be adjusted.

Provision is made on the KA presses for the use of a horn, and machines with capacities up to 60 tons can be equipped with adjustable tables, if required. In addition to these items, the equipment as mentioned in connection with the inclinable machines can be supplied.

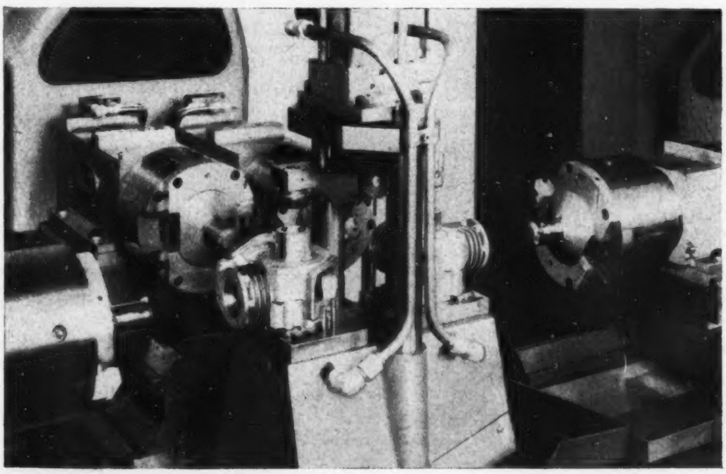
Ex-Cell-O 3-way Machine for Boring, Facing and Chamfering Cylinder Blocks

The Ex-Cell-O Corporation, Detroit, Michigan, U.S.A., have recently built the double-station, 3-way, fine boring machine here illustrated, for performing boring, facing, and chamfering operations on two workpieces at one setting. The component is a die cast aluminium cylinder block, incorporating steel sleeves, for a 90-deg. V-type, twin-cylinder, compressor.

Two castings are loaded manually, and clamped from above by means of a pivoted pad on the piston rod of a hydraulic cylinder. This clamp is seen raised in the illustration. In operation, the four boring spindles are advanced rapidly towards the workpieces, and a finishing cut of 0·060 in. is then taken in each bore, a chamfer being cut at the end of the bore during the last part of the feed stroke. With the spindle heads stationary on the bed, slides are then fed radially to machine the joint faces. Coolant is delivered through a pipe to the centre of each workpiece and directed into the bores.

In spite of comparatively heavy stock removal from the bores, it is stated that a good finish is obtained, suitable for final honing, and that a tolerance of 0·01 in. is maintained. One operator tends two machines, and the output obtained is 220 parts per hour.

The company is associated in this country with Ex-Cell-O Corporation (England), Ltd., Hastings Road, Leicester.

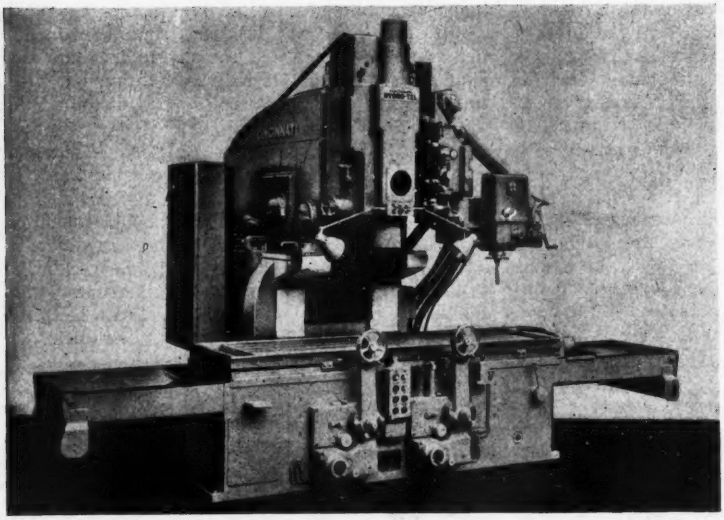


Ex-Cell-O 3-way machine for boring, facing, and chamfering compressor cylinders

Cincinnati Hydro-Tel 28-in. Vertical Milling Machine

Recently introduced by the Milling Machine Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio, U.S.A., the Hydro-Tel 28-in. vertical machine may be arranged for general purpose milling under manual control, or may be adapted, by means of additional equipment from a wide range, for vertical copying for die-sinking, as seen in the illustration, automatic application of increments of cross-feed for line-by-line copying, 360-deg. profiling—with or without provision for manual control, and combined vertical copying and profiling, for example.

Drive to the milling head, which is of new design, is taken from a motor of 10, 15 or 20 h.p., and with the smaller motors there is a choice of six, and with the largest motor a choice of four ranges for the 16 spindle speeds obtainable. To facilitate cutter changing, provision is made for inching and locking the spindle, which has the company's Arbor-Loc nose form. The milling head is mounted on hardened and ground ways, and the work-table, which has a longitudinal traverse of 60 in., is carried on a cross-slide that is also of new design. Movements are imparted hydraulically, and the steplessly variable feeds available range from 1 to



The Cincinnati Hydro-Tel 28-in. vertical milling machine is here shown equipped for die-sinking

15 in. per min. vertically and 1 to 25 or ½ to 12½ in. per min. horizontally. Feed can be applied to the slides individually or simultaneously, and rapid traverse is available for the horizontal motions. Pumps for the hydraulic system are mounted on the tank, which can be removed to facilitate maintenance.

Cincinnati Milling Machine Co. are represented in this country by Cincinnati Milling Machines, Ltd., Kingsbury Road, Tyburn, Birmingham, 24.

Engis Precision Flat Lapping Machine

For the low-cost precision flat lapping machine shown in the illustration, which has been introduced recently by Engis, Ltd., Gabriel's Hill, Maidstone, Kent, a total of five close-grained cast iron plates of 8 in. diameter can be supplied. One of these plates has a turned surface, and the remainder are hand scraped and then finish-lapped with different grades of the company's Hyprez diamond compound, and they have surface finishes ranging from 100 to 120 down to 1 to 3 micro-inches C.L.A.

With the aid of these plates, work-surfaces can be lapped with successively finer compounds, and it is stated that surface flatness down to one light band and finishes to 1 micro-inch C.L.A. can be rapidly obtained. When a change is required, the plate in use is merely lifted off the nose of the vertical spindle, and the fresh one dropped into position.

Drive to the spindle, which runs in two self-sealing ball bearings, is taken from a ¼-h.p. motor through self-aligning couplings and a totally-enclosed reduction unit, whereby a lapping speed of 75 r.p.m. is obtained, and at this speed the operator can safely hold the work by hand. A machined ring is provided at the top of the rigid cast iron body, however, for the attachment of work-holding fixtures, and a fixture to suit components of various shapes and sizes is now in course of development.

Five interchangeable lapping plates, with various surface finishes, can be supplied for this Engis precision flat lapping machine

Weighing almost 1 cwt., the machine occupies an area measuring 1 ft. 10 in. by 11½ in., and is supplied with a cover, for protection from dust when not in use.

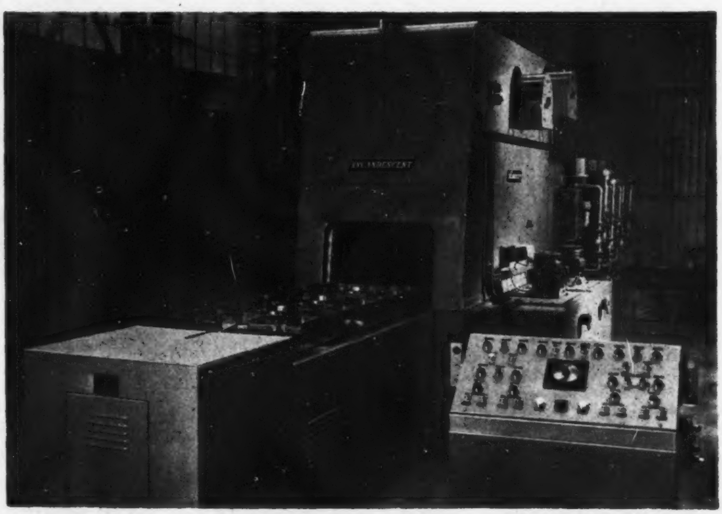
Incandescent Sealed Quench Furnace

In the accompanying illustration is shown the largest of a range of sealed quench furnaces now being made by The Incandescent Heat Co., Ltd., **Cornwall Road, Smethwick, Birmingham.** It has an effective working space of 8 ft. by 3 ft. by 2 ft. The smallest unit in this range of furnaces provides a working space measuring 3 ft. by 2 ft. by 1 ft. 9 in.

Suitable for controlled-atmosphere heat-treatments such as carbonitriding, carburising, clean hardening, and normalising, the furnace will operate at temperatures that may range up to 1,000 deg. C.

Heating is carried out by the fuel-fired Jetube system, which is the subject of British patents 729,470 and 754,542, the alloy tubes employed being of unusually robust construction. This method of heating is claimed to ensure uniformity of temperature, a high rate of heat transfer to the work, and high thermal efficiency, with little maintenance.

The furnace is equipped with heat-resisting alloy roller tracks, to facilitate charging and discharging the work, which is supported in jigs or baskets on alloy trays. Provision can be made for varying degrees of automatically-controlled mechanized operation, covering furnace charging, transfer of work trays, and quenching under controlled atmosphere conditions.



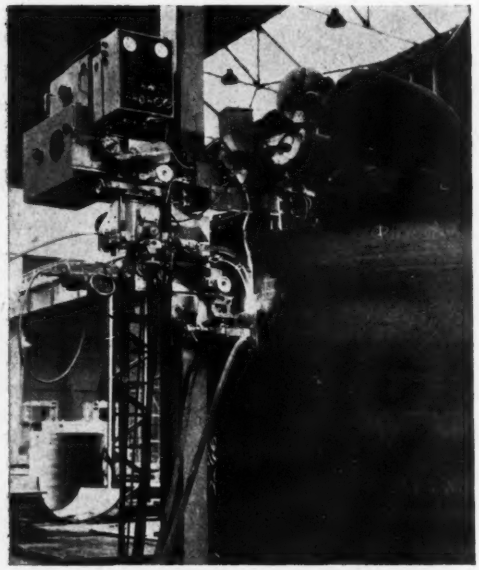
Incandescent sealed quench furnace with patented Jetube heating system

British Oxygen Subarc Electro-slag Welding Machines

Two Subarc electro-slag welding machines which were developed and built at the Gateshead works of British Oxygen Co., Ltd., are being employed at the shipyards of Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for the fabrication of 85 caissons for the legs of an off-shore oil-drilling rig. The sections are 8 ft. high by 8 ft. across, and each is formed by joining two 1⅞-in. plates, which have been previously rolled to the required radius. The plates are set with a gap of about 1¼ in. between their edges, and welding is carried out at a speed of approximately ⅝ in. per min., to complete a joint in less than 2 hours. About 70 lb. of electrode wire is consumed, and the weld is examined radiographically. One of the machines is shown in operation overleaf.

With the Subarc process, a special copper trough is positioned beneath the plates during setting-up, and serves as the base of the cavity formed when two water-cooled copper shoes, carried by the head, are adjusted to contact both faces of the plates and bridge the gap at the lower end. At the beginning of the welding operation, this trough is employed for striking an arc, which serves to fuse the quantity of powder flux contained in the cavity, to form molten slag. The arc is extinguished as soon as the powder melts, and heat for welding is provided by the passage of current through this slag. The electrode wire is reciprocated across the gap, to ensure uniform deposition, and as the pool of weld metal builds up between the shoes, the head is automatically moved vertically on the column at a speed which is controlled by a differential thermo-couple system.

Advantages claimed



One of two British Oxygen Subarc electro-slag welding machines in the shipyards of Swan, Hunter & Wigham Richardson, Ltd., is here shown in operation on a caisson

for the process include elimination of the need for U-edge preparation and reduction of the amount of fettling required for finishing. It is stated, moreover, that joints with a high degree of freedom from slag inclusions, cracking, and porosity are obtained, because of the length of time that the pool of weld metal remains molten.

Gauge for Checking Internal Grooves

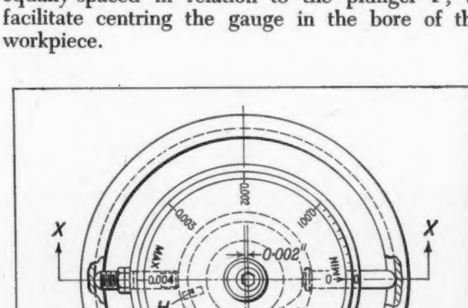
By CHARLES M. BARTLETT

The gauge shown in the accompanying figure is intended for checking the diameters of internal grooves in such components as outer races for ball bearings. In the sectional view, the gauge is shown in position for checking an outer race, and it is designed to operate within a 0·004-in. range on diameter.

There are two main parts, namely, the base *A* and the dial *B*. The base portion is counterbored to receive the boss *C* of the dial, and the periphery of this boss has a cam portion, as indicated at *D*, the significance of which will be explained later. It is arranged that the dial *B* can be turned about the shouldered portion of the screw *E*, and the latter is positioned 0·002 in. off-centre from the parts *B* and *A*. It will be appreciated, therefore, that if the dial *B* is turned through 180 deg., it will be "thrown" through a distance of 0·004 in.

In the rim of the base *A* there are two plungers, as at *F* and *G*, and the former can be adjusted axially and locked in any required position. The plunger *G*, however, is free to slide in the base *A*, and its inner end is in contact with the periphery of the boss *C*. If the dial is turned, the throw of the boss will move the plunger *G* axially into contact with the workpiece, and the amount by which it has moved is read directly from the graduations on the dial.

The graduations on the dial are calibrated with the aid of a micrometer, which is used to take successive measurements over the plungers as the dial is turned. To introduce the gauge into a workpiece, the dial is turned so that the cam form *D* is opposite the plunger *G*, which can then be moved radially inwards. Two pins, as at *H*, project from the boss *C*, and act as stops to limit the turning movement of the dial. If required, two spring-loaded plungers can be incorporated, equally-spaced in relation to the plunger *F*, to facilitate centring the gauge in the bore of the workpiece.



Plan and sectional views of a gauge for checking internal grooves in such components as outer races for ball bearings

It will be appreciated that the gauge is sensitive, since 180 deg. of movement of the dial represents only 0.004 in. of axial motion of the plunger *G*.

Terry Anglepoise Mobile Magnifier

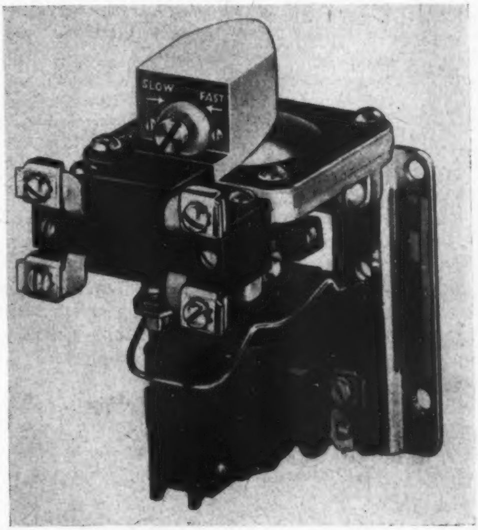
Herbert Terry & Sons, Ltd., Redditch, Worcestershire, have recently introduced an illuminated magnifier for use in drawing offices, inspection departments, laboratories, and for other applications including assembly work where small parts are handled and visual concentration is required. The magnifier, here shown in use in a spring inspection department, incorporates a rectangular lens held in a frame which houses two 25-watt tubular-type lamps that are controlled by a push-button switch.

Of the well-known Terry Anglepoise type, the articulated arm which is employed as a support for the magnifier has a span of 30 in. and is self-sustaining in any position. A universal mounting of simple construction is provided for the magnifier which can be tilted to any desired angle, and is then securely held, so that the operator's hands are freed for work-manipulation or other tasks. The complete equipment is finished in hammered grey enamel, and there is a choice of mountings including a screw down base, a wall bracket, a bench bracket, and a heavy transportable base.

Terry Anglepoise mobile magnifier

Square D Pneumatic Time Delay Relay

Designated class 9050 type A, the pneumatic time delay relay shown in the figure has recently been introduced by Square D, Ltd., Cheney Manor, Swindon, Wilts., as a development of the Class 8501 type D unit. The delay period can be varied from 0·2 sec. to 1 min., and the repeat accuracy is stated to be good, the design being such that normal variations of the operating temperature and the voltage of the electrical supply have little effect. The pneumatic system is in the form of a closed circuit, and dirt is consequently excluded.



Square D Class 9050 Type A pneumatic time delay relay which provides delay periods that may be varied from 0·2 sec. to 1 min. The single-pole, double-throw timed contact is rated for pilot duty at up to 600 volts a.c.

Initiation of the delay period may be effected either by the energization or the de-energization of a magnet coil, which can be provided from a standard range for use on 50- or 60-cycle a.c. electrical supplies at voltages up to 600. The method of operation can be readily altered without the use of additional parts. A single-pole, double-throw timed contact is incorporated, which is rated for pilot duty operation at up to 600 volts a.c.

Trials of Cylinder Block Die Casting Machine

DIE CASTERS FROM BRITAIN, Russia and many European countries were present at the Triulzi works in Milan, Italy, when the new 2,500-ton cold-chamber machine (Alexander Cardew, Ltd., Studio Place, London, S.W.1) underwent full-scale trials. This machine is for export to the Soviet Union, where it will be used for the production of 4-cylinder blocks for the Volga 80-b.h.p. saloon.

A view of the machine is given in Fig. 1, and it is of direct hydraulic type, the main ram displacement being obtained by means of a low-pressure, high-capacity pump to ensure a fast closing stroke. There is provision for positive locking by lateral wedges, which are housed in the entablature, and are advanced into engagement with the die traverse ram at the completion of the closing stroke. A second, high-pressure, circuit then supplies the full locking thrust. The maximum injection capacity is about 100 lb., with a final pressure on the metal up to 28,500 lb. per sq. in.

The platens are 6 ft. square, with a clearance between the tie-bars of 51 in., and the die opening stroke is approximately 5 ft. Die thickness is variable between 2 ft. 3 in. and 4 ft. Provision is made for automatic ladling, the metal being supplied by a SFEAT Dosomatic installation, which operates on the displacement principle. Metal is conducted to the shot-sleeve by way of a gas-heated open launder, and the timing of the filling phase is determined by delay devices in the machine control system. This arrangement ensures that the advance of the plunger is initiated in fixed relation to the completion of filling, one of the variables being thus eliminated from the operating cycle. All the other phases of the cycle, up to the opening of the die and the withdrawal of cores, follow automatically after closure and injection.

The die for the "Volga" engine block, seen set up on the machine in Fig. 2, is of classic design with the external surface disposed symmetrically between the two main die members. Hydraulically-operated sliding cores, housed in the moving member, form the cylinder bores, the crank clearance space, and two recessed panels at the forward and rear ends of the block. The shot-sleeve is located opposite to the lower vertically-moving core-block, and the casting is gated to the inner edge of the sump-attachment flange. The gate area, for the shot weight of about 50 lb., is slightly less than 0·75 sq. in.

An automatic transfer mechanism has been provided, which consists of a welded frame, pivotally mounted at a point external to the die, immediately below one of the lateral core-pulling cylinders. This frame is actuated by a rack-and-pinion mechanism, the rack being reciprocated by a hydraulic cylinder. When swung round into the die space, the transfer device pro-

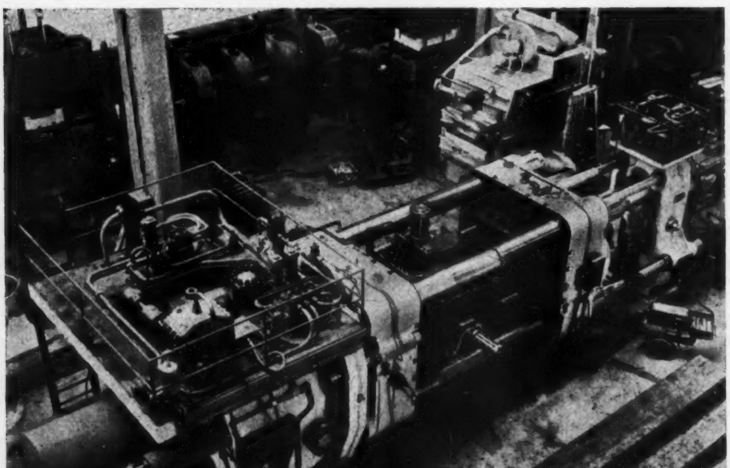


Fig. 1. Triulzi 2,500-ton cold-chamber die casting machine with the die for the Volga cylinder block set up for operation

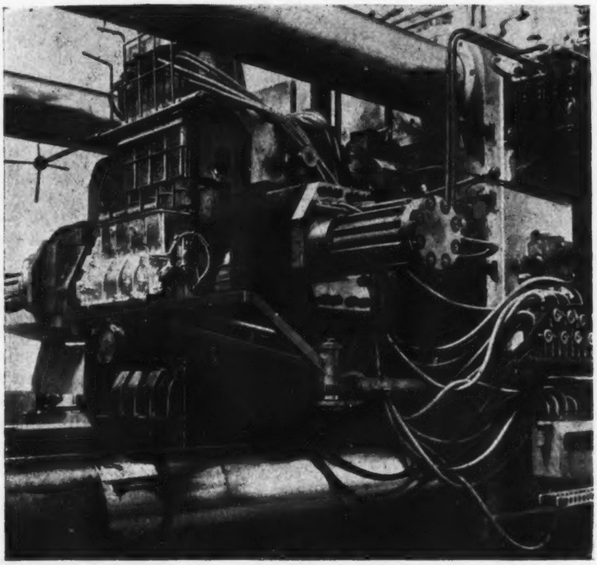


Fig. 2. A view of the moving member of the cylinder block die with the transfer device supporting the ejected casting

vides a platform immediately in front of, and a fraction of an inch below, the cylinder-block casting. Operation of the ejectors pushes the casting clear of the die until it rests upon the platform, and when the ejectors have been retracted, the transfer device is swung out of the die. The block is then lifted from the platform by one of the machine operators, the slug and runner are knocked off, and the casting is checked for weight. It is understood that when the machine is installed in the Soviet car plant, removal of castings from the unloading station is to be conveyorized.

On the test run, the production rate approached 15 blocks per hour, but it was clear that no attempt was being made to achieve rapid operation. Indeed, about three-quarters of each cycle was generally devoted to cleaning and lubricating the die. These operations were easily enough performed, since the size of the machine allows operators to step right into the space between the die blocks. Lubrication by swab and air-blast is seen in progress in Fig. 3, and automatic lubrication of the key areas of the blocks and cores would greatly reduce the time required. The castings, examples of which are shown in Fig. 4, were commendably free from flash, but there was a tendency for flash formed at the slug periphery to tear away and remain in the core-bedding recess of the fixed member, whence it was removed by hand. This trouble could probably be obviated fairly easily by thickening up the flash sheet adjacent to the shot-sleeve so that it would come away with the slug. With these modifications, and one or two other readily-implemented changes in operating procedure, there seems no reason why a production rate of 23 to 25 blocks per hour should not be maintained in regular production of this block.

Whereas the castings produced were sound and of good finish, with the alloy used for the trial run there was a slight tendency for soldering to occur where the metal impinged obliquely on the curved surface of the lower part of the cavity. According to the Russian designer of the engine block, who was present at the trials, the production alloy will be of Alpax type with an 0·8 per cent iron content, and it is believed that with this alloy,

Fig. 3. Lubricating the shot-sleeve in readiness for the next cycle

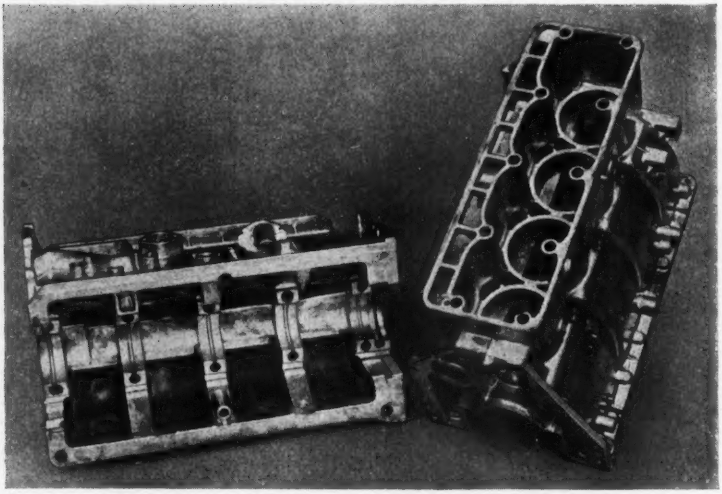


Fig. 4. Views of "as-cast" blocks with runners removed

soldering will be avoided even when the machine is operated at higher injection speeds.

Nesag Spraytron Portable Electrostatic Paint Spraying Equipment

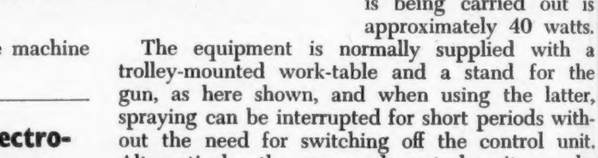
Machine Tool Sales, Ltd., 79 Portland Place, London, W.1, have recently been appointed sole agents in the United Kingdom for the Swiss-made Nesag Spraytron portable electrostatic paint spraying equipment. Weighing approximately 4 lb., the spray gun provided with this equipment can be held at distances between 2 and 20 in. from the work, and incorporates a nozzle which is normally bored 0·03 in. diameter. On discharge from this nozzle, the paint is atomized by a spinner, which is driven at a speed of about 2,500 r.p.m. and is controlled by a trigger-operated switch. Aluminium and plastics spinners are supplied, which are employed according to the type of paint to be sprayed, and are normally of 2 and 2¾ in. diameter.

For electrostatically charging the particles of paint, to ensure that they will be attracted to an earthed workpiece, the spinner is connected to a separate unit which provides a d.c. electrical supply at a potential of the order of 90,000 volts.

Measuring 35½ by 17½ by 14½ in., and weighing 60 lb., this unit will supply two guns, and may be connected to 50- or 60-cycle a.c. mains at various voltages which may range between 110 and 250.

There is no danger of the operator suffering a serious electrical shock, since the maximum short circuit current is only 0·2 milliamp., and when the equipment is connected to a 220-volt power supply, the maximum power consumption when spraying is being carried out is approximately 40 watts.

The equipment is normally supplied with a trolley-mounted work-table and a stand for the gun, as here shown, and when using the latter, spraying can be interrupted for short periods without the need for switching off the control unit. Alternatively, the gun and control unit can be obtained separately, and provision can be made for mounting on the work-table a pressure-feed paint container of 2-gal. capacity.



Nesag Spraytron portable electrostatic paint spraying equipment

British-built U.S. Multi-Slide Machines

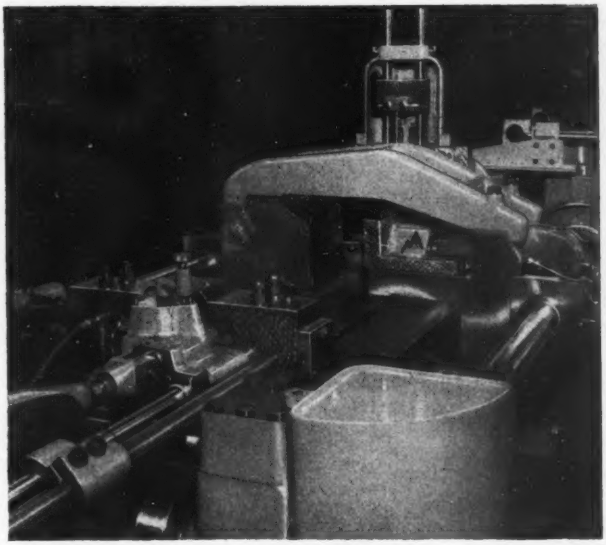


Fig. 1. No. 35 U.S. Multi-Slide machine awaiting tooling before being exported to Belgium

U.S. Multi-Slide machines, built in this country by Alltools, Ltd., Brentford, Middlesex, for Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, are at present available in two versions designated No. 28 and No. 35. Both machines are of horizontal type and are suitable for the production, from coiled stock, of a wide variety of stampings including parts for cameras, typewriters, door locks, telephones, automobile accessories, and industrial switchgear.

Material is saved by utilizing the full width of the stock and by producing blanks in continuous strip form and not in a material web which is later discarded. The bending tools fitted are designed for independent adjustment, and the system of stock feeding is claimed to be extremely accurate in operation. With careful design of the tooling it is sometimes comparatively easy to produce two or three components simultaneously from one strip of material, with the result that the output of the machine is doubled or trebled. Each version of the machine is provided with four forming slides but the smaller—No. 28—size is designed for use with one or two die heads, whereas the No. 35 size may, if required, be equipped with as many as four die heads. The wide range of

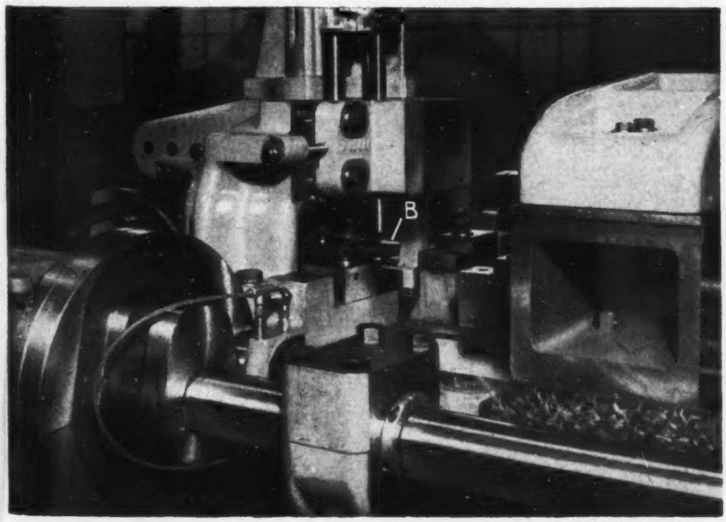


Fig. 2. Close-up view showing the forming slides, stripper mechanism, and micro-switch safety device fitted to a No. 35 machine

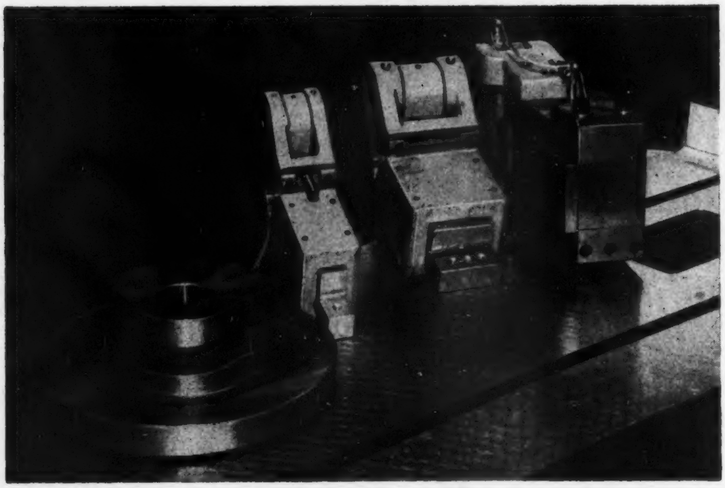


Fig. 3. A split cam and carrier and three slides are here seen resting on the bed of a special No. 35 machine

auxiliary equipment available for both machines includes a toggle press of 100 tons rating for heavy duty swaging and embossing; a rear slide for shearing, forming, or extruding operations, which exerts force in the opposite direction to the die head; and a split slide which permits double movement within the width of a standard slide.

The tonnage rating of either machine is determined by the number of die heads and items of auxiliary equipment employed. A No. 35 machine, for example, when fitted with four die heads is rated at 130 tons, but if provided with two die heads and a 100-ton toggle press is up-graded in rating to 180 tons. Recently, heavy-duty die heads with an additional 5 tons capacity have been introduced to extend the field of application of the No. 35 machines.

On the larger machine, which operates at 40-160 strokes per min., the maximum stock feed is 13 in. and it will accept material up to 3 in. wide by $\frac{3}{32}$ in. thick. Drive is taken from a 7½-h.p. motor, and the machine weighs 9,000 lb. The smaller size has a working speed of 60-240 strokes per min., and a maximum stock feed of 8 in. for material up to 1½ in. wide by $\frac{1}{16}$ in. thick. A driving motor of 2 h.p. is provided and the complete machine weighs 3,300 lb.

Bed frames and other castings are of GM and WA grades of Meehanite iron and the forming slides are mounted in hardened and ground steel ways. All location surfaces are hand scraped, as will be apparent from some of the accompanying illustrations which depict various stages in the building of these machines. Tools are mounted in steel die sets of special design and are supplied with ground and lapped bushings and pins. Punches and dies are mounted individually in the die sets and may

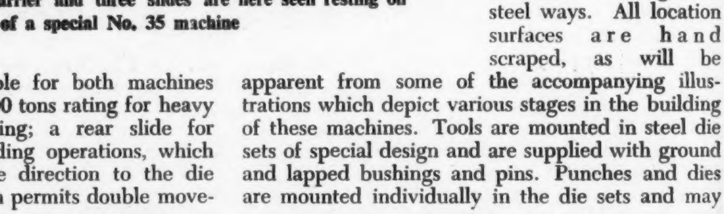


Fig. 4. This No. 28 machine is almost fully assembled

easily be removed for replacement or regrinding when necessary.

Drive is transmitted from the motor through a speed-variator unit and thence by V-belts and a friction clutch, to a shaft system which extends along the sides and ends of the bed, with connection at the corners by means of accurately meshed bevel gearing.

This arrangement of shafting enables die heads, forming slides, and auxiliary units to be mounted with equal facility on either side of the bed to suit tooling requirements. Possibility of damage to the tooling in the event of mis-feeding of the stock, for example, is prevented by a safety device consisting of a micro-switch placed in close proximity to the stripper mechanism. This switch is connected to an electric circuit which, when triggered, energizes a braking device to arrest the motion of the flywheel pulley in less than half a revolution. Lubrication of moving parts is provided by a cam-operated constant pressure oil pump which was supplied by Lumatic, Ltd., Epsom, Surrey.

A view of a No. 35 machine, shown in course of construction and destined for export, fully tooled, is given in Fig. 1. The feed block and stock straightener are seen in the foreground of the figure, and the die head is indicated at *A*.

Fig. 2, which is a view of a No. 35 machine from the rear side, shows the forming slides, stripper mechanism, and the micro switch *B* which triggers the electrically-operated braking system in the event of faulty stock feeding. The cam and calibrated carrier casting in the foreground, which operates a forming slide, is of split construction to facilitate rapid removal and substitution.

In Fig. 3 may be seen the hand-scraped bed of a machine of the No. 35 size, and some of the equipment awaiting assembly. From the left, the items shown comprise a slide cam and carrier, a 1¼-in. rear auxiliary slide, a 3¼-in. rear auxiliary slide, and a front cut-off slide.

The No. 28 machine illustrated in Fig. 4 is in the final stages of construction and it may be noted that the slide feed unit fitted is of recent introduction.

A selection of parts produced on British-built U.S. Multi-Slide machines is shown in Fig. 5 and comprises a 0·300-in. cartridge link *A*, of spring steel; a spring-steel distributor cap *B*; a brass brush holder *C* for a domestic appliance motor; a stainless steel component *D* for a windscreen wiper; and a radio valve anode *E*, with lock seam, in nickel steel.

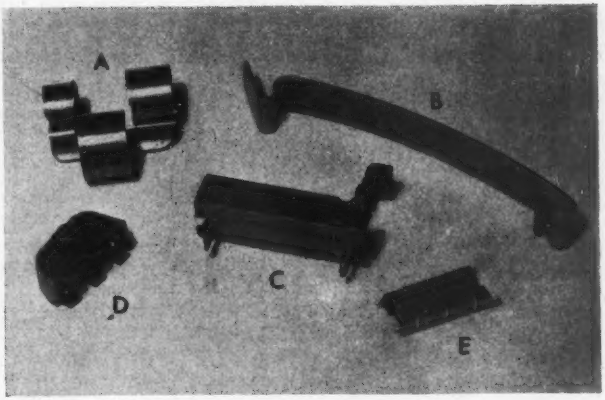


Fig. 5. Typical parts produced on U.S. Multi-Slide machines, without secondary handling, from steel and brass coiled stock

It may be mentioned that the machines have been built in this country for the past five years and that many have been exported, fully tooled, to European and Commonwealth countries. Although of basically similar construction, machines may be modified in the interests of improved production efficiency.

Luster-on 70 Metal Treatment Process

Tool Treatments (Chemicals), Ltd., Colliery Road, Birmingham Road, West Bromwich, Staffs., are now licensed to handle in this country the metal treatment process known as Luster-on 70, developed by The Chemical Corporation, in the U.S.A., for cleaning and/or deoxidizing copper, brass, and bronze components, and for preparing work for electro-plating.

Luster-on 70 is a powder of the protective chromate conversion coating type, and when it is dissolved in water, articles dipped into the solution are chemically polished and passivated, being thus rendered resistant to corrosion, staining and tarnishing. No fumes are generated, and no ventilating equipment is required.

It is stated that the treatment will produce a high degree of lustre with an immersion time as short as 20 sec., involving the removal of less than 0·00005 in. of metal. For maximum lustre the temperature should be between 120 and 140 deg. F.

K

Methods Employed for Machining Beryllium in an American Plant

Fig. 2. To save material, which is an expensive item, the bore in a gyro gimbal is trepanned by the electro-discharge process

BERYLLIUM IS FINDING rapidly increasing application, partly on account of its high strength-weight ratio which is comparatively well maintained at elevated temperatures, and partly on account of its effectiveness as a radiation shield. The metal is produced by chemically processing the ore, followed by melting and pouring in a vacuum chamber. Cast ingots are coarse grained, have directional characteristics, and are normally unsuitable for machining to produce structural parts. For this reason, the ingots are machined into chips, which are next milled to reduce them to powder. Fine grained machining stock is then produced from the powder by hot-pressing. Chips formed during machining operations are carefully collected by extraction systems, both for the protection of the operators from the toxic effects of the metal in finely divided form, and on account of the high cost (35 dollars per lb. in the U.S.A.). These chips also are reduced to powder which is similarly hot-pressed to produce machining blanks.

At the works of the Nuclear Division of the Beryllium Corporation, in Hazelton, Pa., U.S.A., a machine shop, with the necessary extraction system, has been provided, where preliminary operations are performed on many components for manufacturers of missiles and space vehicles. In general, it is stated, machining may be carried at speeds, feeds, and chip loads similar to those employed for operations on cast iron.

Typical of the work undertaken in the shop is the rough machining of the gyro gimbal shown in Fig. 1, which is required for a missile guidance system, and is supplied to the works of the General Electric Co., at Pittsfield, Mass. This part is produced from the solid.

For turning operations, throw-away or brazed tip carbide tools are used, usually with negative or neutral rakes. Both Carboloy 885 and equivalent Kennametal grades have been used with satisfactory results. A cutting speed of 250 ft. per min. is usually tried initially, but lower speeds are sometimes found necessary. For roughing cuts, feeds range from 0·005 to 0·006 in., with a 0·009 to 0·011-in. chip load. Finishing cuts are taken with a 0·002-inch feed, and a surface finish of 8 to 10 micro-inches can thus be obtained. Chip-breakers are not required on account of the brittle-fracture characteristics of the swarf. The

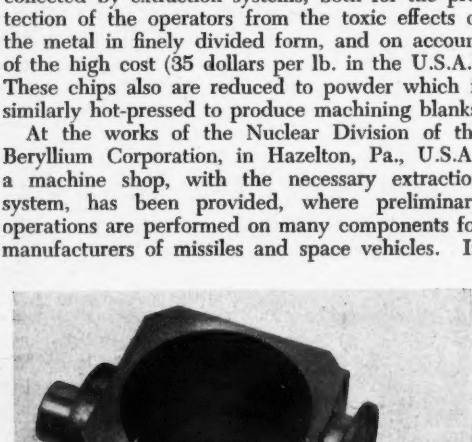


Fig. 1. This gimbal blank for a missile gyro is machined from the solid at the works of the Beryllium Corporation, Hazelton, Pa., U.S.A.

work-surface becomes somewhat burnished under a light cut but does not work-harden. Excessive speed or high chip loading are likely to cause incipient cracks in the surface. Spalling at the ends of workpieces is avoided by bevelling the corners before turning cuts are taken on outside diameters. Guards are provided to enclose the cutting areas on lathes and thus confine the chips.

Milling operations, also, are carried out at a cutting speed of 250 ft. per min. or less, with a feed of 0·009 to 0·012 in. for roughing, and 0·005 to 0·006 in. for finishing. Carbide-tipped cutters are employed, with the largest possible numbers of teeth, to enable high metal removal rates to be obtained. Chip disposal presents no problem. Climb milling is usual, to avoid break-out at the end of a pass, and a finish of 35 micro-inches is normally obtained. If a smoother surface is required, a final light pass may be taken with a fly-cutter, and under these circumstances beryllium does not smear in the same way as does steel or aluminium.

Solid carbide and carbide-tipped drills are used, and are ground to a 125-deg. included-angle. The lip faces are ground without rake to reduce drill grab on breaking through. No coolant is applied for any machining in order to avoid contamination of the chips, since it is better to sacrifice tool life than to risk loss of valuable material.

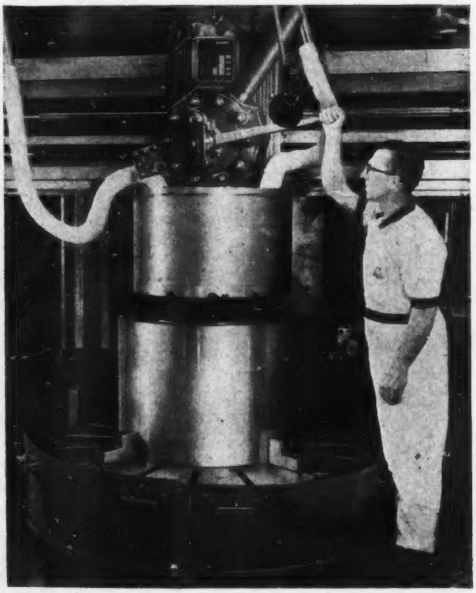


Fig. 3. For producing a large ring economically, a special carbide-tipped trepanning tool is employed on a large Bullard vertical turret lathe

Owing to the high cost of beryllium, various operations are performed by methods that would not normally be economical. For example, the cradle hole in the gimbal has a diameter of 2·625 in. and is of similar depth. Because it is vital to save as much metal as possible, instead of being bored, the hole is trepanned by electro-discharge machining on a 60-amp. Cincinnati Elektro-jet machine, as seen in Fig. 2. To machine this bore and leave the largest possible core, the electrode employed is brass tubing with a wall 0·050 in. thick. Certain other electrodes are made from low-density-compacted tungsten, infiltrated with silver. The feed rate for the trepanning cut is 3 in. per hour, and the diameter is held to close limits.

Because the work is immersed in dielectric oil during the electro-discharge trepanning operation, oxidation does not take place and the swarf can be recovered. The dielectric oil is a standard Cincinnati Milling Machine Co. product.

Larger bores are trepanned on a Bullard vertical turret lathe, a set-up for such an operation being shown in Fig. 3.

APPLICATION OF VYON POROUS PLASTICS FOR SILENCING AIR VALVES.—Porous Plastics, Ltd., Dagenham Dock, Essex, have developed a range of silencers suitable for the complete series of pneumatic control valves made by Martonair, Ltd., Richmond, Surrey. These silencers, which are also applicable to other makes of valves, are made from Vyon, a porous plastics material produced from high-density polyethylene of medium pore size, and it is stated that the noise from air valves is effectively silenced without loss of efficiency. The material will withstand hard usage and its permeable structure permits very high air flow. Silencers fit directly into the exhaust ports of valves and the exhausting air escapes to atmosphere through the porous plastics bodies. It is reported that since the beginning of this year, Vyon silencers for more than 20,000 Martonair valves, in sizes from ⅛ to 1 in. B.S.P., have been supplied.

PRODUCTION OF VACUUM CLEANERS in the U.K. during February, 1961, was 101,300 units (value £1,218,500) and 23,500 cleaners (value £188,800) were exported. For 1960, the average monthly output of cleaners was 109,700 (value £1,404,900) and 20,600 (value £176,500) were exported.

A Simple Interferometer for the Precise Measurement of the Straightness of Cylindrical Surfaces

By R. G. N. HALL, A.M.I.Mech.E., A.M.I.Prod.E.

(Communication from the National Physical Laboratory)

For a number of years the National Physical Laboratory has been concerned with the production of diffraction gratings derived from very fine helices ruled on accurately finished metal cylinders, Ref. 1.2.3. (All references at end of article.)

The metal cylinders or mandrels, which may be up to 12 in. long and 2 in. diameter, are usually of brass and need to be polished and figured to optical standards. It is essential throughout the polishing process that any errors of the straightness of their generators are known to an accuracy of ± 20 micro-inches. In order to evaluate the figure of these cylinders, an interferometric technique has been developed which is capable of measuring the straightness of a generator to an accuracy of ± 5 micro-inches.

By using this technique actual contact with the metal surface during measurement is unnecessary, and soft metals can thus be examined without damage.

It is well known that when interference occurs between light reflected from two slightly inclined truly plane surfaces, as in a Fizeau interferometer, a series of fringes can be observed. These fringes are straight, parallel, and equidistant. If either surface is curved the fringes are also curved, and the error of the surface is deduced by measuring the departure of a fringe from a straight line joining its ends in terms of the mean fringe separation. If, however, one of the surfaces is a cylinder with its axis parallel to the reference flat, fringes will be observed parallel to the cylinder generator. Such fringes are no longer equidistant, but their spacing follows a quadratic law, becoming closer the greater the distance from the generator nearest the flat. The straightness of a generator is indicated, therefore, by the straightness of the fringes that lie on either side of the generator nearest the flat, but the evaluation of the error of a generator to a precision of 1 micro-inch requires a measurement of the spatial fringe separation to an accu-

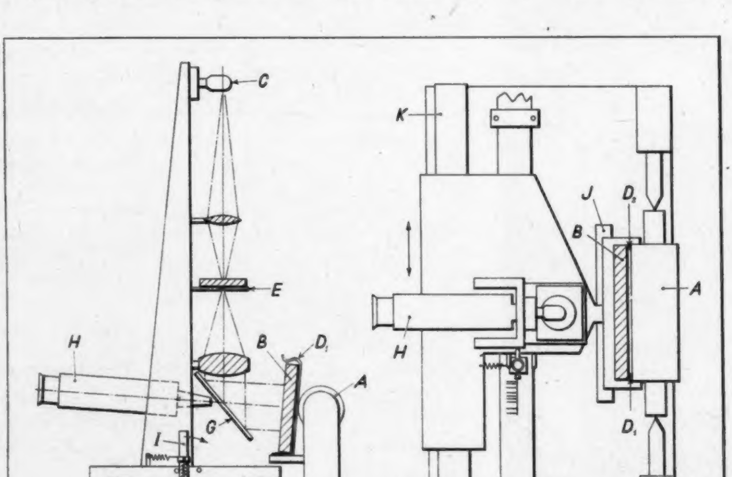


Fig. 1. Diagram of the interferometer for measuring the straightness of cylindrical surfaces

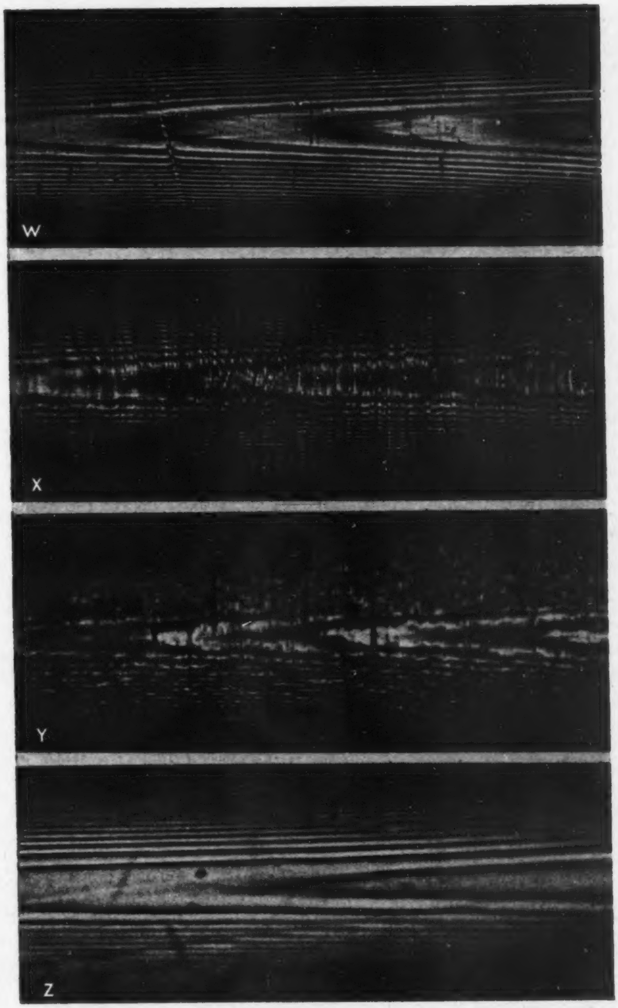


Fig. 2. (*W*) Fringe system produced by polished speculum-plated cylinder (approx. 17 fringes per inch). (*X*) Fringe system produced by a precision ground brass cylinder (approx. 12 fringes per inch). (*Y*) Fringe system produced by a part-polished brass cylinder (approx. 12 fringes per inch). (*Z*) Configuration of fringe from polished surface. Wedge angle adjusted to give approximately 7 fringes per inch. These photomicrographs have been reproduced half full size

racy of a few ten thousandths of an inch for a 1 inch diameter cylinder (Ref. 4).

If, however, a small inclination is introduced between the cylinder and the reference flat the fringes on either side of the generator converge to meet at a series of points along it. The pattern of the fringes is now similar to a series of arrow-heads with their tips lying along the generator. Such fringes will occur at positions where the separation between the two surfaces has altered by precisely one half wavelength of the illuminating light and whereas for a true generator the tips will be equally spaced, any curvature present will be denoted by irregular spacing of these fringes.

Monochromatic light of a wavelength of approximately 21·6 micro-inches (the green line of a mercury source) has been used for this work. It is therefore possible, by selecting an appropriate angle between the flat and cylinder, to produce a fringe frequency along the generator such that a displacement of a fringe position of 0·015 in. is equivalent to a generator error of 1 micro-inch.

DESCRIPTION OF APPARATUS

The measuring equipment is shown diagrammatically in Fig. 1 and with the exception of the optical flat the components do not require accurate machining and fitting.

The cylinder *A* to be measured is held by male centres attached to the main base of the equipment. The reference flat *B*, which is bismuth oxide coated to improve fringe contrast, is supported in a nearly vertical position but leans towards the cylinder. This near vertical arrangement of the reference flat eliminates distortions which might arise if it were mounted horizontally. The wedge angle between flat and cylinder is controlled by two thin wire spacers D_1 and D_2, of slightly different diameters, situated near the extreme ends of the cylinder, and affixed to the flat.

Fringes are viewed by a 40 × microscope *H* mounted on a carriage which can be moved on slideways parallel to the mandrel to be examined. A miniature mercury vapour lamp (Siemens M.2)

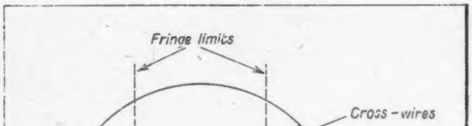


Fig. 3. Diagram showing cross-wires at setting position on fringe

C is mounted well above the carriage. In order to obtain monochromatic light from the lamp, a Wratten 77A filter is placed on the aperture platform E. Collimation of the light is effected by the lens F, and the resulting parallel light is reflected by the beam-splitter G to strike the optical flat at normal incidence.

The carriage for the microscope, beam-splitter, etc., is kinematically supported by two vees sliding on the cylindrical rod K and by a hemisphere, sliding on the flat J. The vees are spaced at a distance apart of 12 in., and the measuring scale, against which the positions of the fringes are determined, is about 4 in. from the surface being examined. Since it is only necessary to measure the position of any fringe, if the number of fringes per inch is approximately 7, to an accuracy of 0·015 in. to achieve an accuracy of 1 micro-inch, the straightness of the guide ways is relatively unimportant. For example, a local error of 0·045 in. in straightness of the guide rod K will only introduce an error of approximately 1 micro-inch in the determination of the straightness of the generator being examined.

The position of the microscope carriage can be recorded by marking a paper tape with the pen I. If required, the tape and pen may be replaced by a simple scale and cursor.

OBSERVATIONAL PROCEDURE

The number of fringes observed along the length of a generator in the interferometer will depend on the wavelength of the light source and the difference in diameter of the wire spacers D_1 and D_2 (Fig. 1).

Hence, the number of fringes per inch=

$$2\,(D_1 - D_2)/\lambda\,L$$

where L = distance between wire spacers (in.)
D_1 and D_2 = wire spacer diameters (in.)
λ = source wavelength (in.)

Wires of 0·0014 in. and 0·001 in. diameter will give a frequency of 6 to 7 fringes per inch at a separation of 6 in. or about 3 per inch at a separation of 12 in., and both these conditions have been found to be satisfactory in practice.

The fringes appear in the viewing microscope as sharp arrow heads, Fig. 2 (w) and (z). The criterion chosen for setting is that the cross-wire of the microscope should be at the centre of gravity of the fringe, i.e. at a point mid-way between the tip of the arrow and the position where the fringe separates, Fig. 2 (z) and Fig. 3. The distance between tip and point of separation is usually about 0·030 in. for a fringe frequency of about 7 per inch. When the first fringe has been located the position of the slide carrying the microscope is recorded. The carriage is then moved until the next fringe occupies a similar position relative to the microscope cross-wires, the position is again recorded, and this procedure is repeated for every subsequent fringe.

DETERMINATION OF ERRORS

Where scale readings of fringe positions have been taken it is first necessary to determine the mean fringe frequency (F_f) by dividing the total number of fringes (counting the first as zero) by the distance between the first and last.

The departure of the generator from a straight line, in fringes, will then be the difference between the integral number of fringes observed at any point and the calculated fringe number based on the mean fringe frequency. Thus the error at the n^{th} fringe position is given by,

$$\text{Generator error } (G_e) = [(F_f \times S) - n] \text{ fringes}$$

where F_f = number of fringes per inch (calculated)
S = distance between first and n^{th} fringe
n = number of fringes (observed)

Provided measurements are made from the small to the large wire diameter, a negative value of the generator error indicates a concave and a positive value a convex surface. The accompanying table shows a typical example for a generator, concave

by approximately 68 micro-inches, i.e. a " waisted " cylinder.

For most work calculation is unnecessary and a graphicial solution may be derived from the paper tape. Using this technique it is only necessary to set the microscope to a fringe position and depress the marker pen. Not only are the possibilities of error of reading the position minimised, but measurements may be made without disturbing the observer's adaptation. This is very convenient especially under conditions of poor fringe contrast.

The paper tape derived is used as a scale to construct the graph illustrated at *a* in Fig. 4. The ordinates relative to a straight line drawn between the end fringe positions, are the errors of the generator and can be conveniently replotted in the form shown at *b* in Fig. 4.

Provided the measurements are made from the small to the large wire diameter and the plotting origin is top left, errors below the straight line indicate concavity or minus metal and errors above, convexity or excess metal.

TABLE OF GENERATOR ERRORS DERIVED FROM SCALE READINGS

Fringe No. (observed) n	Fringe position (in.) S	Fringe No. (calculated) $F_f \times S$	Generator error (fringes) $[(F_f \times S) - n]$ G_e	Generator error micro-inches $G_e \times 10{\cdot}8$
0	0	0	0	0
1	0·06	0·42	−0·58	−6·26
2	0·16	1·13	−0·87	−9·40
3	0·20	1·41	−1·59	−17·17
4	0·30	2·11	−1·89	−20·41
5	0·39	2·74	−2·26	−24·41
6	0·48	3·38	−2·62	−28·30
7	0·58	4·08	−2·92	−31·54
8	0·69	4·85	−3·15	−34·02
9	0·80	5·63	−3·37	−36·40
10	0·90	6·33	−3·67	−39·64
11	1·00	7·03	−3·97	−42·88
12	1·10	7·74	−4·26	−46·01
13	1·24	8·72	−4·28	−46·22
14	1·36	9·56	−4·44	−47·95
15	1·46	10·27	−4·73	−51·08
16	1·59	11·18	−4·82	−52·06
17	1·70	11·96	−5·04	−54·43
18	1·82	12·80	−5·20	−56·16
19	1·94	13·64	−5·36	−57·89
20	2·06	14·49	−5·51	−59·51
21	2·18	15·33	−5·67	−61·24
22	2·29	16·11	−5·89	−63·61
23	2·42	17·02	−5·98	−64·58
24	2·56	18·00	−6·00	−64·80
25	2·66	18·71	−6·29	−67·93
26	2·81	19·76	−6·24	−67·39
27	2·96	20·82	−6·18	−66·74
28	3·12	21·94	−6·06	−65·45
29	3·26	22·93	−6·07	−65·56
30	3·39	23·84	−6·16	−66·53
31	3·52	24·76	−6·24	−67·39
32	3·69	25·95	−6·05	−65·34
33	3·88	27·29	−5·71	−61·67
34	4·08	28·69	−5·31	−57·35
35	4·26	29·96	−5·04	−54·43
36	4·42	31·09	−4·91	−53·03
37	4·62	32·49	−4·51	−48·71
38	4·87	34·25	−3·75	−40·50
39	5·13	36·08	−2·92	−31·54
40	5·45	38·33	−1·67	−18·04
41	5·83	41·00	0	0

Fringe frequency $F_f = 41/5{\cdot}83 = 7{\cdot}033$.

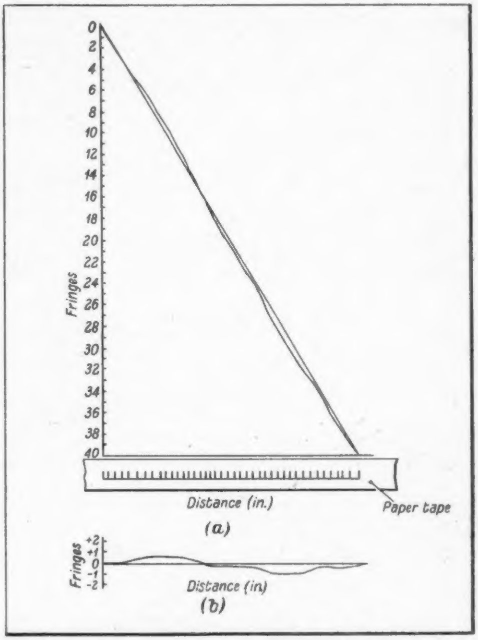


Fig. 4. (*a*) Plot of fringe positions from paper tape. (*b*) Plot of generator errors from (*a*)

ACCURACY OF DETERMINATION

The limitation of accuracy of this equipment is imposed by the micro-structure of the surface being measured. The apparatus has been mainly used to test the straightness of brass cylinders and although the finish of the brass, when polishing has been completed, is highly specular, irregularities on a micro-scale are often present which are sufficient to impair the fringe quality and hence influence the fiducial setting of the microscope. The greatest discrepancies in fringe setting occur when measurements are taken during the intermediate stages of polishing. Here, lack of repetition of the order of ± 3 micro-inches has been found to exist between sets of readings for the same generator. The reasons for disagreement of this magnitude will be apparent if the fringe configurations illustrated in Fig. 2 (x) and (y) are studied.

Another source of error is, of course, the accuracy with which the position of the microscope carriage can be determined, but it is quite

easy to read the paper tape or scale to an accuracy of ±0·010 in., which, for a normal fringe frequency, is equivalent to an error in the generator curve of less than 1 micro-inch. The errors of the reference flat must, of course, be known and if necessary these corrections can be easily applied to the error curve derived for the cylinder. Calibration of the flat can be made to an accuracy of ±1 micro-inch and it may be mentioned that it is only necessary to calibrate the line of the flat against which the comparison with the cylinder is to be made.

CONCLUSIONS

The accuracy of the method depends greatly, as has been mentioned, on the quality of the surface being measured. However, it is considered that the overall accuracy when applied to brass specimens in the early stages of polishing is of the order of ±5 micro-inches and that as the quality of the surface improves this error is reduced to probably ±3 micro-inches. Higher accuracies can undoubtedly be obtained with surfaces which incorporate finer micro-structures.

The technique described has been developed specifically for measuring mandrels for diffraction grating manufacture. Provided a suitable reference flat is available there does not appear to be any limit to size. The system as used is not particularly susceptible to vibration, and the equipment may, therefore, be installed in or near a workshop, if suitable temperature controlled conditions exist.

ACKNOWLEDGMENTS

The author wishes to acknowledge the contributions made to the experimental work by Mrs. P. J. McCormick. The work described above has been carried out as part of the research programme of the National Physical Laboratory and this paper is published by permission of the Director of the Laboratory.

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TransfeRobot 200 Automatic Work Handling Equipment

Equipment known as the TransfeRobot 200 has recently been developed by U.S. Industries, Inc., Robodyne Division, Silver Spring, Maryland, U.S.A., for handling workpieces with individual weights up to about 1 lb. for assembly and other operations. For instance, the equipment may be employed for loading components on to conveyors and dial-type feed tables for presses, also for positioning workpieces for such operations as welding, staking, marking, drilling, stamping, heat sealing, and embossing. A TransfeRobot 200 unit, fitted with a special attachment, is shown at A in the illustration, set up at the La Salle, Illinois, works of the Westclox Division of General Time Corp., for applying lubricant to a total of eight spindle bearings of clock assemblies, simultaneously. For this operation, the individual clock assemblies, mounted on platens, are moved towards and away from the position at which lubricant is applied, by an indexing-type conveyor, and the cycle time is about 1 sec.

For assembly and certain other operations, workpieces may be delivered to the equipment by a magazine or vibratory hopper feed unit, and the individual part is normally held by a pair of solenoid-operated gripper jaws carried on a vertical slide. This assembly is mounted at the end of a horizontal, rectangular-section ram, which can slide on guideways in the base. When the jaws have been closed, the ram is advanced, and the slide is then moved downwards to bring the workpiece to the required position. If desired, the jaws may then be opened to release the work before the slide and ram are returned to their original positions to complete the cycle. Alternatively, the jaws may continue to hold the work while a particular operation is being performed. The work is then returned to its original position during the withdrawal movements of the ram and the slide. With another method of operation, the jaws can be closed to pick up a workpiece after the ram has been advanced, and the slide moved to the bottom of its stroke.

Interchangeable jaws, of different sizes and shapes to suit the work to be handled, also jaw assemblies which can be swivelled in the horizontal plane, or turned in the vertical plane for inverting the work, can be mounted on the slide. In addition, vacuum or electro-magnetic pick-up heads can be fitted. The working stroke can be varied from 3 to 10 in. for the horizontal ram, and from ⅝ to 2 in. for the slide, and the equipment is operated by a mechanism housed in the base, at speeds which can be varied from 1 to 50 cycles per min. The unit has an overall length of 27$\frac{11}{16}$ in., and a width of 5⅜ in., and the overall

A TransfeRobot 200 unit is here shown set up for applying lubricant to a total of eight spindle bearings of a clock mechanism, simultaneously. The assemblies are transported on an indexing-type conveyor

height, with the slide at the top of its travel, is $10\frac{7}{32}$ in.

Transistorized electronic equipment for controlling the movements of the ram, slide, and jaws is housed in a separate unit which occupies a space of only $5\frac{3}{8}$ by $5\frac{1}{2}$ in., and has an overall height of $8\frac{5}{16}$ in. This unit is connected to the equipment by cables to provide remote control, and carries at one end a number of switches for pre-setting the sequence of movements. An interlocking system is incorporated to stop the equipment and associated machines, and to energize an audible or visual warning system, in the event of faulty operation. Signals can be transmitted by the control unit at pre-determined points during an operating cycle to start other TransfeRobot units or machines. For instance, it is reported that in one installation a TransfeRobot unit is employed for feeding components to a trimming press, and that at the end of each loading operation, a signal is transmitted to start the press.

TransfeRobot units with capacities for handling larger and smaller components are being developed. The makers are represented in this country by U.S. Industries, Inc. (Great Britain), Ltd., New Bond Street House, 1-5 New Bond Street, London, W.1, and the equipment is to be produced by Burtonwood Engineering Co., Ltd.

Books Received

Works Accident Statistics. Part 2: Records and Analysis. The Royal Society for the Prevention of Accidents, Terminal House, 52 Grosvenor Gardens, London, S.W.1. 38 pp. [Price 5s.]

Issued as safety organization pamphlet No. 6, this booklet analyses the purposes for which accident records are compiled, and advances a system for recording data in a manner which will provide the safety officer "with a source of useful and assimilable facts about accident causes and injury locations." It is shown what statistics are necessary, and convenient ways of compiling them to give information which will be of value in preventing industrial accidents, and thus improving industrial efficiency.

Aids to Machine Shop Practice. By C. T. Bower, A.M.I.Prod.E. Odhams Press Ltd., 96 Long Acre, London, W.C.2. 192 pp. [Price 18s. net.]

The subject matter of this book is arranged in 13 sections, namely: assembly methods; drawing-office aids; drilling and tapping; gauging and testing; grinding practice; work handling; jigs, fixtures and machine attachments; lathe work; machine-shop maintenance; marking out; milling work; production methods; and welding practice. The devices and methods described are clearly illustrated by means of line drawings and photographs.

Cold Forging of Steel. By Dr.-Ing. Heinz D. Feldmann. Hutchinson & Co. (Publishers), Ltd., 178-202 Great Portland Street, London, W.1. 268 pp. [Price 40s. 0d. net.]

The importance of cold forging and cold extrusion for economic production has been more and more appreciated during recent years, and the fundamental techniques have been progressively improved. In this book, the author, who is intimately associated with the commercial application, has given a comprehensive account of the process.

Following an introduction which gives the terminology and symbols used, and a brief historical survey, there is a fairly complete dissertation on the fundamental theory. Next comes a discussion of the types of forging steels, methods of making them, and their faults, followed by sections on heat treatment, the structure of steel, grain patterns, and steel quality. The industrial application of cold forging is dealt with at some length, including the economic aspects, and reference is made to the design of different forms of workpiece, and the subsequent coating and joining of such components. Some economic comparisons are made between cold forging and other manufacturing processes.

Other sections are concerned with surface treatments, heat-treatment plant, machines for cold forging, and the application of the technique to munitions manufacture. The book is very well produced and particular attention is drawn to the high standard of the illustrations.

NEWS OF THE INDUSTRY

The South

T. & A. NASH (PENN), LTD., St. John's Road, Tyler's Green, Penn, Bucks., who are associated with Holtspur Engineering Co., Ltd., Hatter's Lane, High Wycombe, Bucks., are busy with contract machining for a number of well known firms, and work in progress includes, for example, rolling mill rolls 8 ft. long by 14 in. diameter, crankcases, moulds for the rubber industry, cement "guns," weld-fabricated steel structures, and repetition parts. The accompanying illustration shows a fabricated steel part weighing 5 tons, which is typical of the work undertaken by the company, set up for machining on a Collet & Englehard 4 ft. by 4 ft. by 4 ft. horizontal boring machine. It may be noted that the overhanging portion of the work is supported by a hoist in order to ensure a stable set-up and obviate undue stressing of the work-table and machine frame.

Lang, Colchester and Cardiff centre lathes, and Ward capstan lathes, provide good facilities for a wide variety of turning operations. Other machine tools installed in the works include 80-in. swing vertical boring mills by Webster & Bennett, radial drilling machines by Asquith and Midgley & Sutcliffe, milling machines by Parkinson, grinding machines for cylindrical and centreless work by Churchill and Scrivener, respectively, and 6-spindle automatics of 1-in. and 1⅝-in. capacity by Wickman.

A large, weld-fabricated steel part is here shown set up on a Collet & Englehard horizontal boring machine in the works of T. & A. Nash (Penn), Ltd. The weight of the overhanging portion is supported by a hoist

A. DOUGLAS CO., LTD., Lincoln Road, High Wycombe, Bucks., are now well established in their new premises which they occupied about a year ago. The offices, store rooms, and warehouse are of modern design and occupy part of a 2½-acre site which affords space for subsequent extension of the existing buildings in accordance with a development programme. There is good access to the main warehouse, which is equipped with a 5½-ton capacity overhead crane for handling machine tools and other heavy equipment. A brisk demand is reported for centre lathes and capstan lathes, also for milling and drilling machine. It may be noted that the company handles a wide variety of machine tools of British and foreign makes, also engineers' small tools, ground flat stock, and oil-hardening die steel.

AIRMEC, LTD., Cressex Industrial Estate, High Wycombe, are still very busy with the production of a wide range of electro-mechanical and electronic equipment for industrial and experimental purposes. It is reported that there is sustained interest in the company's Autoset co-ordinate setting equipment which is being employed on an increasing scale for positioning, under tape control, work-tables of boring, punching and drilling machines, also, when desired, for tool selection. If tape control is not required the positioning of a co-ordinate table and the selection of the appropriate tool can be controlled from a panel fitted with manually-operated switches.

An interesting machine designed for drilling holes in steel plates, measuring up to 20 ft. by 14 ft., to an accuracy stated to be within 0·01 in. over the entire table area, has been provided with a dual Autoset installation for spindle-head positioning, one unit operating as a master controller and the other as a monitor. Signals from both units must be in agreement before the master controller can initiate a machining operation, and with this safeguard, it is claimed, drill positioning errors are virtually impossible. The range of Airmec products includes a portable transistorized frequency meter which may be employed as a tachometer when supplied with pulses transmitted from an optical probe incorporating a light source and a photo-transistor. Light rays reaching the probe intermittently, from a prepared reflecting surface on a rotating shaft, are counted by the frequency meter, and speeds up to 300,000 r.p.m. are indicated on a scale.

F. W. Herridge.

Lancashire

Thomas Ryder & Sons, Ltd., Turner Bridge Works, Bolton, inform us that their works are busy with the production of the full range of Verticalauto machines, and special tooling and automatic work handling equipment. We understand that this company is making increasing use of the services of sub-contractors to enable the constantly expanding demand for the various products to be met.

In addition, the output capacity of the shops has been augmented by the installation of new plant which has included a Radyne induction hardening machine, a Parkson vertical milling machine, a Kearns type 721.P. Optimetric boring machine, two Edgwick 8-in. centre lathes, and a model 540 surface grinder and a model EIT.1300 universal grinder by Jones & Shipman. Apart from these machines, the following are on order for delivery in the near future: a Butler shaper, a Parkson vertical milling machine, and a Thompson surface grinder fitted with an auxiliary head.

Thomas Robinson & Sons, Ltd., Rochdale, report full capacity working in all departments to meet the growing demand for their range of woodworking machinery and equipment and flour milling plant. We are informed that this company has recently installed in a customer's works the first yard bogie/cross-cut saw/moulder transfer line in the United Kingdom. This line, which provides for primary timber preparation on a conveyorized basis, is controlled by one operator.

Among new machine tools recently installed in the works may be mentioned a Parkson universal milling machine, a Herbert 9C combination turret lathe, two Ward 2DS capstan lathes, a Frost beading and swaging machine, and a Kerry band type cutting-off saw. A Ward No. 7 capstan lathe is on order for early delivery.

Propulsion, The Lodge, Greenbank Mills, Greengate Street, Oldham, inform us that there has been an increase in demand for their range of marine propellers and stern-gear equipment which they produce in a range of sizes from 10 to 50 b.h.p. It may be noted that the volume of orders for contract machining work and for jigs, fixtures and special tools, which are made by the associated Vertoma Jig & Tool Co., Ltd., has steadily increased in recent months.

New plant installed in the works has included an Archdale milling machine and a Dean, Smith & Grace, 16-in. swing, surfacing and boring lathe.

J. H. Humphreys & Sons, Ltd., Blackriding Works, Werneth, Oldham, inform us that they are occupied to full capacity with the production of their range of magnetic chucks and demagnetizers, for which there is an increasing call from a growing number of customers in a wide range of industries.

S. Crowther (Royton), Ltd., Milton Street, Royton, Oldham, makers of a wide range of stern-gear equipment and propellers for the marine engineering industry, inform us that there has been a steady increase in the volume of orders in recent months. This company also undertakes precision contract machining work of various types, and the construction of machines and equipment for special purposes, both to their own designs and to those of customers. From this section of the works a number of creep testing machines was recently despatched to the National Engineering Laboratory, East Kilbride, and further orders for creep testing machines are now in hand, totalling 163 in all, for various research laboratories.

R. Sutcliffe.

David Brown Factory Move

Owing to rapid growth of demand, particularly from export markets which are at present taking 75 per cent of the total output, the facilities available at the Sherborne Street, Manchester, factory of the David Brown Machine Tool Division, have become inadequate. Fresh premises, which provide approximately three times the production floor area that has been available hitherto, have therefore been acquired at Trafford Park, 3½ miles from the Sherborne Street works, on a site with ample space for future expansion.

To avoid interference with production schedules

The Trafford Park premises to which the plant of the David Brown Machine Tool Division is now being transferred

it was arranged that the plant should be transferred during the annual holiday. Much preparatory work had to be carried out at Trafford Park at short notice, including the laying of concrete foundations up to 3 ft. thick in a special bay which will be devoted to the production of the largest machines, with weights up to 130 tons.

Transfer of plant, including 1,500 tons of machinery, was begun on August 11, and is scheduled for completion before work is resumed on August 28.

Formate Gears

In MACHINERY, 98/1252—31/5/61, reference was made to the cutting of "formate" gears on the Russian type 525 automatic spiral bevel and hypoid gear generator which was shown this year at the Leipzig Fair. We are asked to point out that the word Formate is a trade mark of Gleason Works, 1000 University Avenue, Rochester 3, N.Y., U.S.A., and is registered in various countries. The British registrations are No. 569663 for gears, and No. 690147 for machines.

Trade Publications

WILCOX & LINES, LTD., Bromford Lane, Erdington, Birmingham, 24. Leaflet drawing attention to the company's activities in connection with the production of hot stampings and pressings in brass and light alloy.

LONDON FAN & MOTOR CO., LTD., 331 Sandycombe Road, Richmond, Surrey. Brochure giving details of Breeza roof ventilation units, which are available in A and B types, with fan diameters of 12, 15, 18 and 24 in., and various operating speeds. A range of base units for mounting on flat or ridge roofs can be supplied.

WILD-BARFIELD ELECTRIC FURNACES, LTD. Otterspool Way, Watford By-Pass, Watford, Herts. Illustrated leaflet describing the 4-kW sealed quench slipper furnace, for clean hardening small components under controlled conditions. The slipper is 4-in. wide by 6-in. long, and the 12- by 26- by 20-in. deep quench tank is equipped with an agitator and a heater. The maximum operating temperature is 950 deg. C.

THE GENERAL ELECTRIC CO., LTD., OF ENGLAND, Rotating Plant Division, Witton, Birmingham, 6. Revised technical description No. 277 relating to high torque, high slip, and high reactance squirrel cage motors. Separate sections are devoted to the different types of motor, and speed-torque curves are given also a table in which the starting performances of a high torque squirrel cage motor, an ordinary squirrel cage motor, and a slip-ring motor are compared.

BRITISH RAWHIDE BELTING CO., LTD., 246-248 Great Portland Street, London, W.1. Third edition of the company's catalogue concerned with nylon and gears. It includes technical notes on nylon, and information, with prices, on "Toughness" nylon balls, bushes, section material, tubing, sheet, slat conveyor chains, screws, washers, and various other items. In the gear section reference is made to spur and bevel gears, chain drives, rawhide blanks and pinions, Texolex blanks, and three sizes of worm reduction gearboxes.

THE LONDON SHAFTING & PULLEY CO., LTD., 18-22 Northdown Street, London, N.1. Leaflet PT2/160 describing Atlas pin-type flexible couplings, which are available with outside diameters from 4 to 15 in., and with numbers of pins and rubber bushes from 3 to 14. Also leaflet AD1/60 on Atlas disc-type flexible couplings, in sizes from 4 to 13 in. diameter, with ratings per 100 r.p.m. from 1·1 to 61 h.p. Another leaflet is concerned with the preliminary stock range of Com-Pac WedgeV belt drives in the $\frac{3}{8}$-in. X-section, and with single and multi-groove belt pulleys and Atlas taper-grip bushes. These belts are also made in $\frac{5}{8}$-in. and 1-in. sizes, designated Y-section and Z-section.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs. Publication of exceptional quality of presentation entitled "Control for Industry," and including numerous illustrations, some of which are in full colour. In an introductory section, the significance of automatic control of industrial processes is explained. Subsequent sections are concerned with the aims and methods of the company and with typical applications of standard and special products. These applications cover, for example, automatic register control for newspaper colour printing, high speed testing of tyres, automatic cut-to-length control for strip materials, finger-tip steering control for large

machine tools, and automatic current control for welding. In addition, there are notes on the various types of equipment supplied, and on the activities of the different divisions of the company.

Metal Cutting with the Plasma Torch

(*Continued from page* 403)

than that required for plasma generation, so that the saving in running cost would be offset to some extent by higher overhead charges and depreciation. Arc-plasma cutting also suffers from the drawback that the kerf width for a given plate thickness is approximately double that produced by a flame.

Even when due allowance is made for these disadvantages, however, it appears likely that the application of the plasma process will be rapidly extended, at least for work of a certain thickness range, in view of the possibilities which it offers for much more rapid and economical cutting.

U.S. Machine Tool Exports

The following table gives the quantities and value of exports of various classes of machine tools from U.S.A. during March, 1961.

	Number	Value $
Light duty and bench lathes	110	51,286
Engine lathes	72	274,685
Turret lathes	23	367,217
Automatic chucking and between-centre lathes	44	836,681
Automatic screw machines	25	758,438
Other lathes	11	104,485
Vertical boring and turning mills and vertical turret lathes	8	119,545
Fine boring machines	7	131,767
Jig boring machines	10	419,809
Tapping and threading machines	202	126,494
Milling machines	122	1,144,395
Profiling, duplicating and diesinking machines (milling type)	20	1,061,740
Gear grinding and finishing machines	39	774,394
Gear cutting machines	106	2,504,820
Drilling machines	308	643,138
Planing, shaping and slotting machines	43	471,136
Surface grinding machines	76	707,239
Tool and cutter grinding machines	154	371,372
Other grinding machines	396	2,299,329
Sawing and cutting-off machines	71	361,279
Honing and lapping machines	66	306,003
Multi-station machine tools	11	797,886
Broaching machines	11	279,777
Hydraulic presses	99	982,350
Mechanical presses	164	1,876,760
Bending and roll forming machines	150	773,113
Punching and shearing machines	182	362,822
Forging machines and hammers	33	827,357
Other machines	159	733,583

Industrial Notes

FIRTH CLEVELAND TOOLS, LTD., inform us that their sales office has been moved from London to Locarno Works, Locarno Road, Tipton, Staffs., to enable more efficient service to be provided.

HALL HARDING, LTD., Newcastle Branch, 113 Pilgrim Street, Newcastle-upon-Tyne, will hold an exhibition of photo-copying and drawing office equipment and materials, from September 25 to 28, at The Old Assembly Rooms, Westgate Road, Newcastle.

LAWES RABJOHNS, LTD., Abbey House, Victoria Street, London, S.W.1, will stage exhibitions covering drawing office, print room, and surveying requirements, at The Town Hall, Middlesbrough, from October 3 to 6, and at The Town Hall, Bolton, from October 24 to 27.

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous stores will be held at the W.D. Storage Depot, Royal Arsenal, Woolwich, London, S.E.18, on August 29 to 31. The auctioneers will be Fuller Horsey, Sons & Cassell (Dept. L), 10 Lloyd's Avenue, London, E.C.3.

STEEL AND PIG IRON PRODUCTION.—In July, the output of steel, which was affected by holidays, averaged 380,200 tons per week, as compared with 447,500 tons in June, and 391,400 tons in July, 1960. For pig iron, the corresponding figures were 276,600 tons, 297,400 tons, and 288,900 tons.

BROOK ELECTRIC MOTORS OF CANADA, LTD., have moved to larger premises at Rexdale, near Toronto Airport. The warehouse at this address has 10,000 sq. ft. of floor space, and will enable a wider variety of types to be stocked. Some plant will be installed to enable limited modifications to be carried out for the convenience of customers.

FURNASCOTE, LTD., 16-18 Malvern Road, Southampton (telephone, Southampton 71347), will in future make and market Furnascote refractory coatings, hitherto produced and sold by Corrosion, Ltd. From September 1, all enquiries and correspondence should be sent to the sales director, Mr. G. L. Barron, A.I.R.I.(Sc.), at the above address.

AN ELECTRONIC DATA PROCESSING SYMPOSIUM is to be held at Olympia on October 4 to 6, during the period of the Electronic Computer Exhibition. It will be concerned with the experiences of managers "in putting computers to work in the control of business and other organizations." Copies of the programme can be obtained from the organizing office for the Electronic Computer Exhibition, 64 Cannon Street, London, E.C.4.

ROCOL, LTD., Rocol House, Swillington, Nr. Leeds, have introduced Molytherm grease for the lubrication of industrial plant and machinery which operates at temperatures above 350 deg. F. It is stated that it will withstand temperatures above 450 deg. F. for long periods, and up to 550 deg. F. for short periods. The properties and applications of this grease are described in the company's publication No. 17.

LAPOINTE MACHINE TOOL CO., LTD., Otterspool, Watford By-Pass, Watford, Herts., recently despatched a 15-ton, 90-in. stroke, double ram vertical broaching machine, to complete an order for six machines, with full tooling equipment, for the General Motors' plant at Buenos Aires in the Argentine. The value of the order was about £75,000. The 15 by 90 D.R.V. machine is equipped with carbide tipped broaches to General Motors' specification, for contour broaching bearing clusters.

DESIGN APPRECIATION COURSES FOR ENGINEERS.—The Council of Industrial Design, The Design Centre, 28 Haymarket, London, S.W.1, is to hold the following design appreciation courses: A staff course in two phases, from October 23 to 27, and from November 20 to 24, and a course for executives from November 27 to December 1. Both will be held in the London area, and will be residential. Forms and further particulars can be obtained from the Education Officer, Miss Sydney Foott, at the above address.

THE WELDING ENGINEERING 1962 EXHIBITION, which will be the first organized by the Institute of Welding, 54 Princes Gate, Exhibition Road, London, S.W.7, will be held at Buxton from May 2 to 4, in conjunction with the spring meeting. It will cover the various processes and aspects with which the Institute is primarily concerned, including welding, brazing, soldering, cutting, metal spraying, manipulating, inspection, testing, and safety. The closing date for space reservation is January 1, and full particulars can be obtained from the Exhibition Department of the Institute, at the above address.

PURCHASING OFFICERS ASSOCIATION CONFERENCE.—The 1961 Conference and Minibition of the Purchasing Officers Association, Wardrobe Court, 146a Queen Victoria Street, London, E.C.4, will be held at Brighton from September 28 to 30. The opening address will be given by the Right Hon. Edward Heath, M.B.E., M.P., Lord Privy Seal, who will speak on "The Common Market," and Dr. E. N. Hague, M.Sc., Ph.D., purchasing manager, Shell Petroleum Co., Ltd., will discuss "Late Deliveries." Buyers for industrial concerns can obtain copies of the programme from the above address.

STANDARDS FOR ZINC COATINGS.—A revised edition of B.S. 729 (zinc coatings on iron and steel articles) has been divided into two parts, concerned with (1) hot-dip galvanized coatings and (2) sherardized coatings. In addition to visual examination and the Preece copper sulphate dip continuity test, requirements for weight of coating have been introduced in Part 1. Guidance is also given on threaded work, and an accepted procedure is indicated. In Part 2, visual examination and the copper sulphate dip test are alone specified.

Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1 [Price 4s. (Part 1) and 3s. (Part 2)—postage extra to non-subscribers].

Zeiss Measuring Instrument Course

The 14th International Instructional Course on Fine Measuring Instruments will be held by Carl Zeiss, Jena, at the Imperial College of Science and Technology, London, from September 11 to 22. It will be the first time that the course has been presented in this country, and it will not be held here again for many years. Ten experts in various aspects of metrology, including Dr. E. Hultzsch, Dipl.-Ing. Heinz Zill, Dipl.-Ing. Günther Kiltz, Dipl.-Ing. Günther Böswetter, Dipl.-Ing. Wolfgang Schumann, will present papers on such subjects as gear design and development, gear measurement, contour projection, and optical measuring microscopes, and will give demonstrations and practical instruction. Among instruments which will be available, may be mentioned a universal horizontal Metroscope, a light sectioning tester, a gear wheel tester, a small bore measuring microscope, and an angle division tester. Arrangements for the course are being made by C.Z. Scientific Instruments, Ltd., 12a Golden Square, London, W.1. The charge for the course is £26 5s. per person, and it is anticipated that some 60 engineers from leading companies and Government Departments will attend.

Cryogenics Equipment Agreement

W. P. Butterfield (Engineers), Ltd., P.O. Box No. 38, Shipley, Yorks., inform us that they have recently concluded an agreement with Ryan Industries, Inc., Cleveland, Ohio, U.S.A., whereby complete technical information relating to the full range of Ryan cryogenic equipment will be made available, to enable this equipment to be produced at Shipley. The arrangement also provides for sole marketing rights in the United Kingdom, all European countries, and West Africa.

Butterfield (Engineers) have been producing, for some years, vessels for the storage of liquid gases, and in future they will be able to offer vessels to Ryan designs for both transportation and storage of liquid oxygen, nitrogen, argon, hydrogen, and helium. These vessels will range in capacity from 30 to 4,800 U.S. gal., and certain special vessels may be as large as 11,000 U.S. gal.

Obituary

Mr. George H. Jackson, who was chairman of Chaseside Engineering Co., Ltd., Hertford, Herts., until 1958, when the firm amalgamated with British Northrop, Ltd., died recently as a result of a motor accident in Derbyshire. He was the originator in Europe of the mobile loading shovel, and produced his first Chaseside loader in 1925.

Mr. E. I. Bondy, founder and managing director of B.P.S. Machinery & Spares Co., Ltd., 245 Knightsbridge, London, S.W.7, died recently after a short illness. Before he came to this country, Mr. Bondy had a distinguished career in engineering in Czechoslovakia and India, and in the latter country he was responsible for founding the first small tool works to start production there. Later he played an important part in the introduction of unit head machines in British factories, also the Burgsmuller Thread-whirling process.

Personal

Mr. George A. France, standards engineer with James Archdale & Co., Ltd., Worcester, has been accepted as a member of the American Standards Engineers Society.

The following new appointments have been announced:—

Mr. H. C. H. Matthews, B.Sc., A.M.I.E.E., as a technical director of Pantak, Ltd., Vale Road, Windsor.

Mr. W. S. Sinclair as manager of the Cardiff office of The Incandescent Heat Co., Ltd., Smethwick, 40. He has completed 12 years' service with the company.

Mr. J. Johnston as European marketing manager for the European operations of Vickers, Inc. He will be located at Lausanne, Switzerland. His responsibilities will still include sales in this country, but this area will be mainly under the direction of Mr. W. B. Robinson, who becomes marketing manager for Stein Atkinson Vickers Hydraulics, Ltd., 197 Knightsbridge, London, S.W.7, for Great Britain.

Correction

In Machinery, 99/296—9/8/61, reference was made to a milling fixture incorporating Spencer, Franklin PowRlock clamping heads and boosters, which is used for milling petrol pump components at the Crayford works of Vickers-Armstrongs (Engineers), Ltd. We have been asked to point out that a clamping force of 1,700 lb. is applied by each head, when the booster is supplied with air at 40 lb. per sq. in.

Scrap Metals

Midlands.—Conditions prevailing in the immediate post-holiday period in this area suggest that trading is not likely to show much early improvement. Steelworks are only accepting very limited allocations and merchants are unable to find markets in other areas for surplus tonnages. It appears that all steelworks are holding ample stocks of scrap, apart from the fact that they are having to cut back their melting programmes on account of a reduction in orders.

Baled scrap of all grades is available from local yards and in consequence merchants have reduced their prices for loose light steel, black iron, and destructor material. Demand for chipped turnings is still very much below normal and merchants are hard pressed to move such scrap from local factories. Limited tonnages of bushy turnings are being disposed of but prices have fallen by at least 10s. per ton.

Short heavy steel scrap, and particularly the lower grade material, is difficult to place with local foundries which appear to want only limited tonnages of top grade scrap. Cast iron still continues to be the type of scrap in greatest demand and there is a ready sale for all grades to Black Country foundries.

In general, over the next few weeks, producers of scrap will be more concerned with ensuring that the material arising is cleared from their works than obtaining top prices.

Machine Tool Share Market

Very quiet and mainly subdued conditions prevailed in stock markets during the period under review, sentiment having been affected by various factors including international political uncertainties.

After an easier trend had been shown generally, however, a rallying tendency developed, and most sections finished on a fairly steady note.

The gilt-edged market provided a firm exception, and British Funds, together with other high grade fixed interest stocks, closed with a general improvement.

Commercial and industrial markets were dull and unsettled on the whole, but after some sharp setbacks, the tone strengthened following moderate selective buying, and final prices were above the lowest.

Among machine tool issues Arnott & Harrison advanced 6d. to 9s. 6d.; John Harper, 1½d. to 7s. 1½d.; Stedall & Co., 3d. to 7s. 6d.; and Tap & Die Corporation, 3d. to 16s. 6d. On the other hand, Edgar Allen lost 1s. 9d. at 35s. 3d.; Birmingham Small Arms, 6d. at 23s.; British Oxygen, 1s. 6d. at 18s. 6d.; Chas. Churchill, 1½d. at 9s. 1½d.; Geo. Cohen, 3d. at 11s.; Coventry Gauge & Tool, 6d. at 28s. 10½d.; Craven Bros. (Manchester), 4½d. at 8s. 9d.; A. A. Jones & Shipman, 3s. at 24s. 6d.; Macready's Metal, 1s. 6d. at 15s.; Noble & Lund, 3d. at 5s. 9d.; Samuel Osborn, 1s. 6d. at 48s.; Ambrose Shardlow, 5s. at 55s.; Scottish Machine Tool 6d. at 8s. 6d.; and Thos. W. Ward, 1s. 3d. at 72s. 6d.

New Companies Registered*

HERTS. & ESSEX ENGINEERING CO., LTD., 8 Queen Street, London, E.C.4. Registered August 1, 1961. Nom. cap. £10,000. Directors: J. Morgan, L. J. Foley, and J. G. Boniface.

MEDWAY PRECISION, LTD., Owens Way, Gads Hill, Gillingham, Kent. Registered July 25, 1961. To carry on the business of precision engineers, etc. Nom. cap. £3,000 in £1 shares. Directors: N. P. Higgins and J. B. Morris.

PRESTON ENGINEERS (PRECISION), LTD., Laurel Street, Preston. Registered August 2, 1961. To take over the business of precision engineers carried on at Preston as "Jack Cattle," etc. Nom. cap.: £20,000. Permanent directors: J. Cattle and Mrs. E. Cattle.

* From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	35/3
,, ,,	5% Prf.	£1	13/-*
Arnott & Harrison, Ltd.	Ord.	4/-	9/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	9/6
,, ,, ,,	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	23/-
,, ,, ,,	5% Cum. "A" Prf.	£1	14/-
,, ,, ,,	6% Cum. "B" Prf.	£1	15/6
,, ,, ,,	4% 1st Mort. Deb.	Stk.	92½
British Oxygen Co., Ltd.	Ord.	5/-	18/6
,, ,, ,,	6% Cum. Prf.	£1	19/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	8/10½
Broom & Wade, Ltd.	Ord.	5/-	24/9
,, ,,	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	15/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	15/-
,, ,, ,,	5% Cum. Prf.	£1	12/6
Churchill (Charles) & Co., Ltd.	Ord.	2/-	9/1½
,, ,, ,,	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	7/6 ex capt.
Cohen (George), 600 Group, Ltd.	Ord.	5/-	11/-
,, ,, ,,	4½% Cum. Prf.	£1	11/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	28/10½
,, ,, ,,	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/9
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/6
,, ,,	4½% Red. Cum. Prf.	£1	12/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/-
Greenwood & Batley, Ltd.	Ord.	10/-	20/1½
Harper (John) & Co., Ltd.	Ord.	5/-	7/1½
,, ,, ,,	4½% Red. Cum. Prf.	£1	11/7½
Herbert (Alfred), Ltd.	Ord.	£1	66/6xd
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	20/-
,, ,,	"B" Ord.	5/-	18/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	24/6
,, ,, ,,	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	10/-
,, ,, ,,	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	22/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	9/-
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	7/6
Newman Industries, Ltd.	Ord.	2/-	7/-
,, ,,	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/9xd
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8/6
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	48/-
,, ,, ,,	5½% Cum. Prf.	£1	22/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	17/9
Sanderson Kayser, Ltd.	Ord.	10/-	29/4½
,, ,,	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	8/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	55/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	15/7½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/3
,, ,, ,,	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	28/9
Tap & Die Corporation, Ltd.	Ord.	5/-	16/6
,, ,, ,,	4½% Deb. 1961-1977	Stk.	80½
Wadkin, Ltd.	Ord.	10/-	26/-
Ward (Thos. W.), Ltd.	Ord.	£1	72/6
,, ,,	5% Cum. 1st Pref.	£1	13/6
,, ,,	5% Cum. 2nd Pref.	£1	20/-
Willson Lathes, Ltd.	Ord.	1/-	3/-

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

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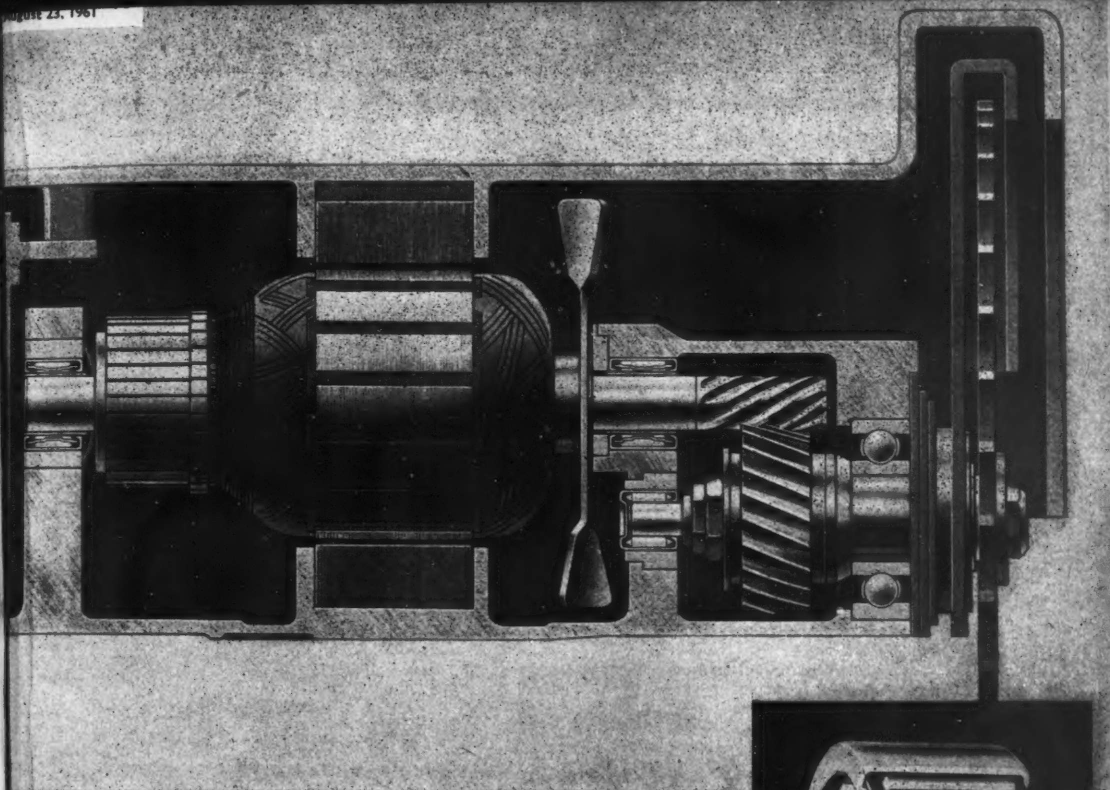
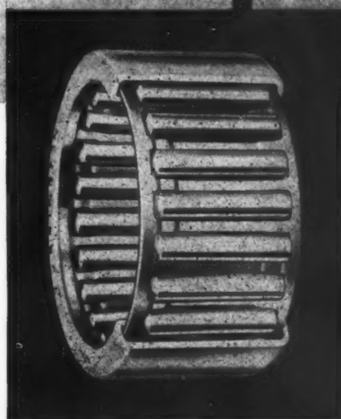
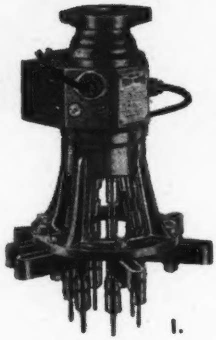




MULTI-DRILLING & TAPPING



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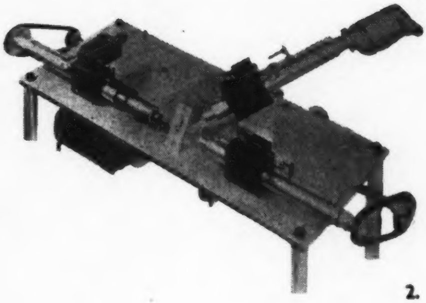

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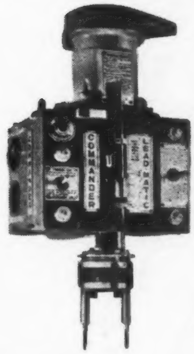

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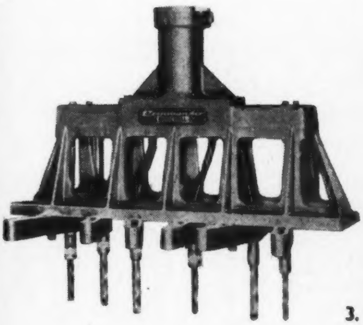

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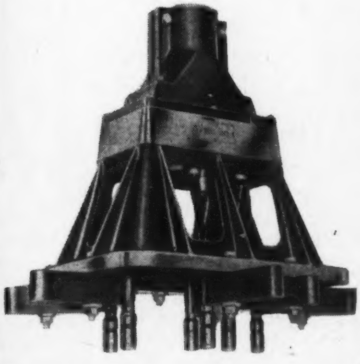

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4. 2-SPEED MULTI-DRILL Model 8-12

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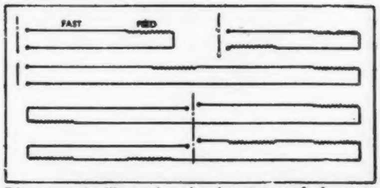

Diagrammatic illustration showing some of the many cycles available.

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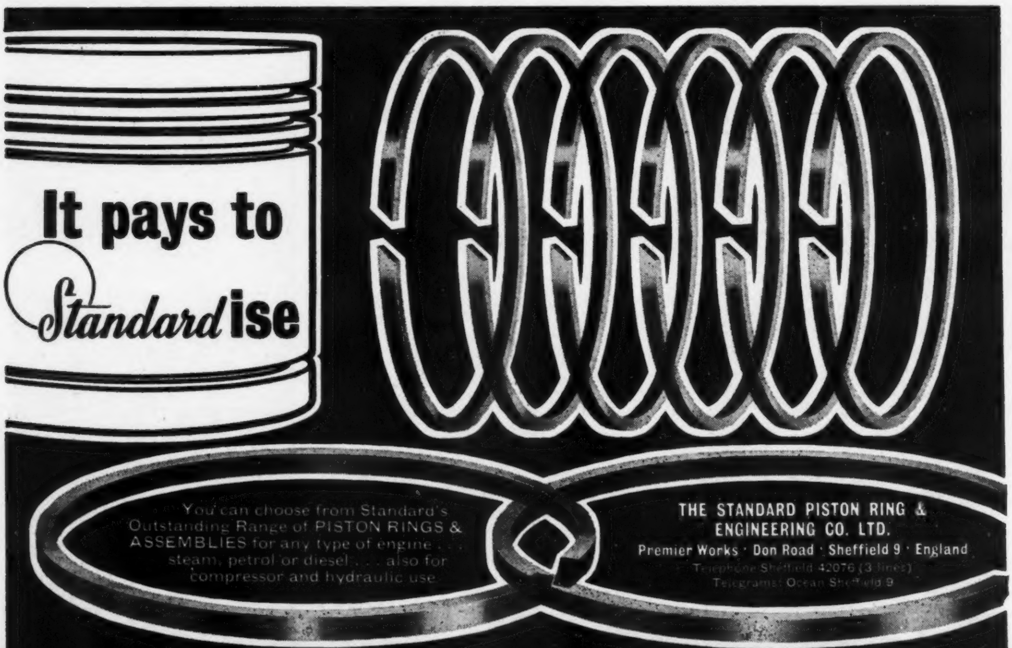

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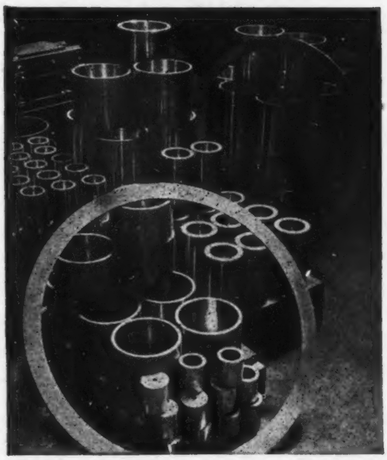

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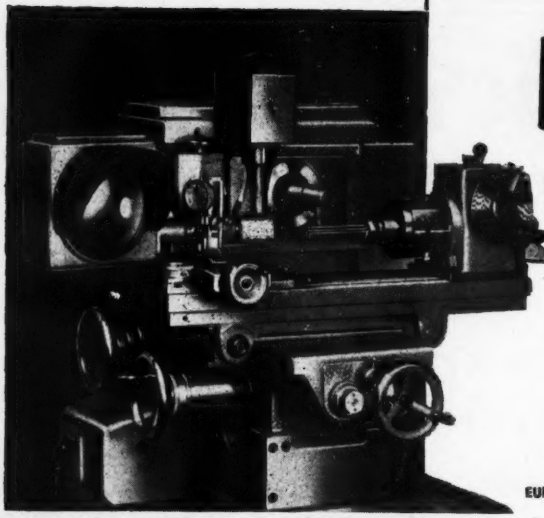

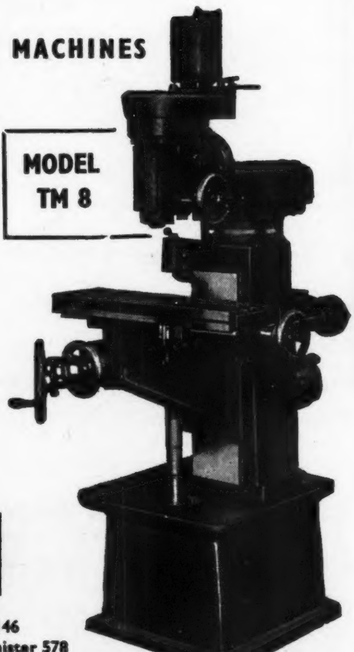


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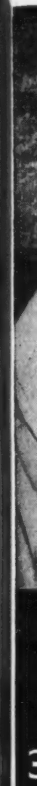

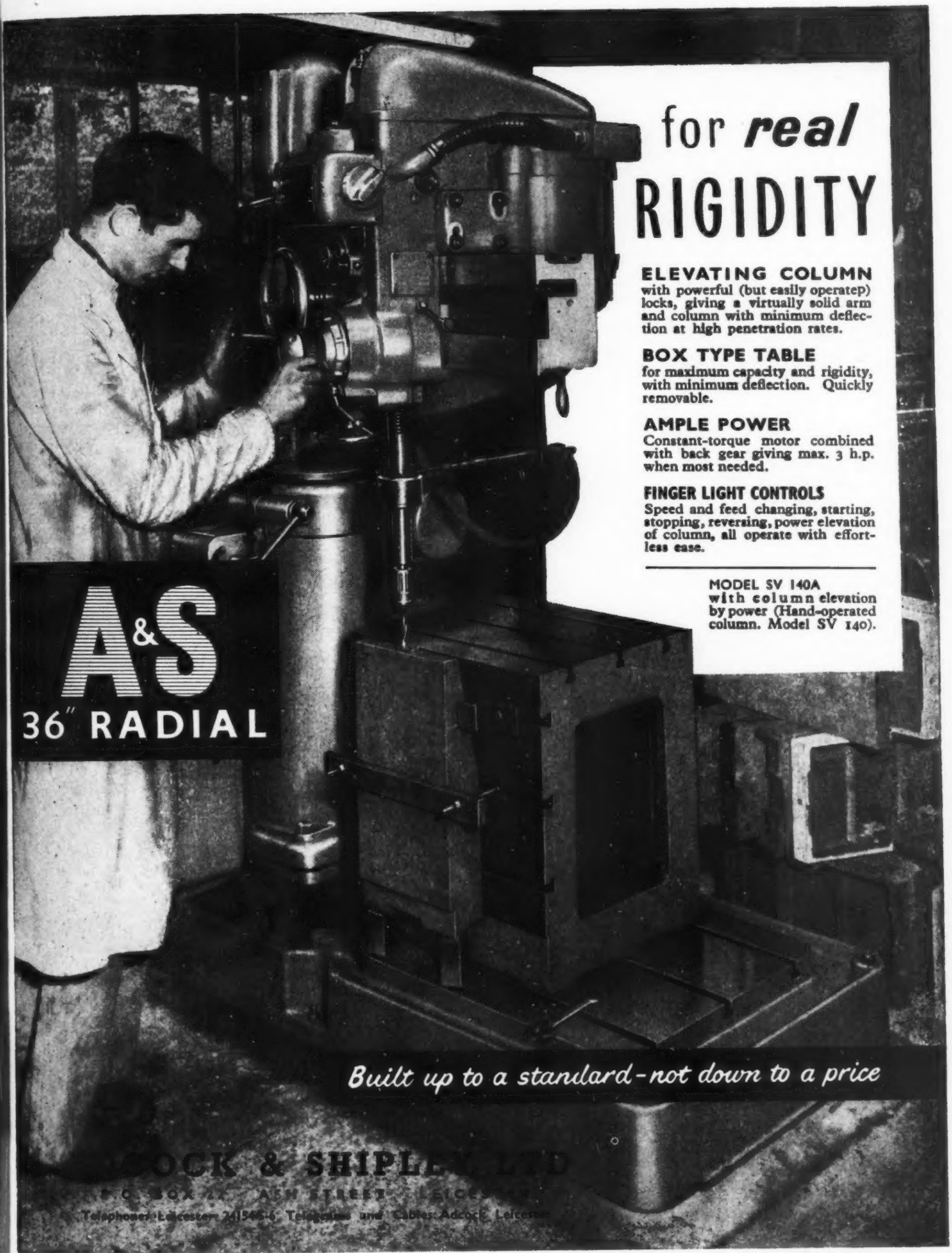
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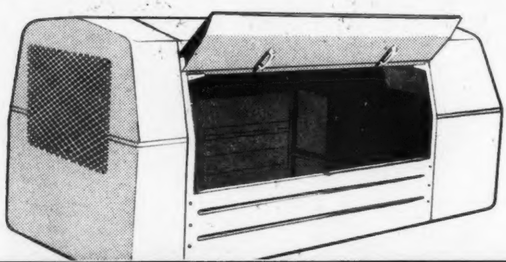

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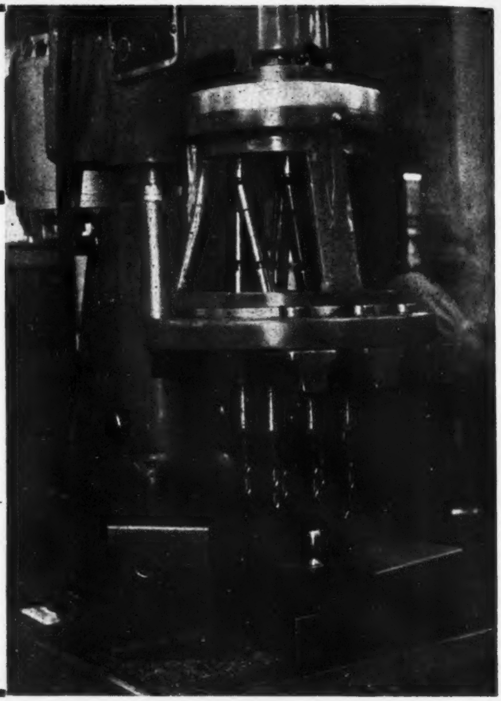

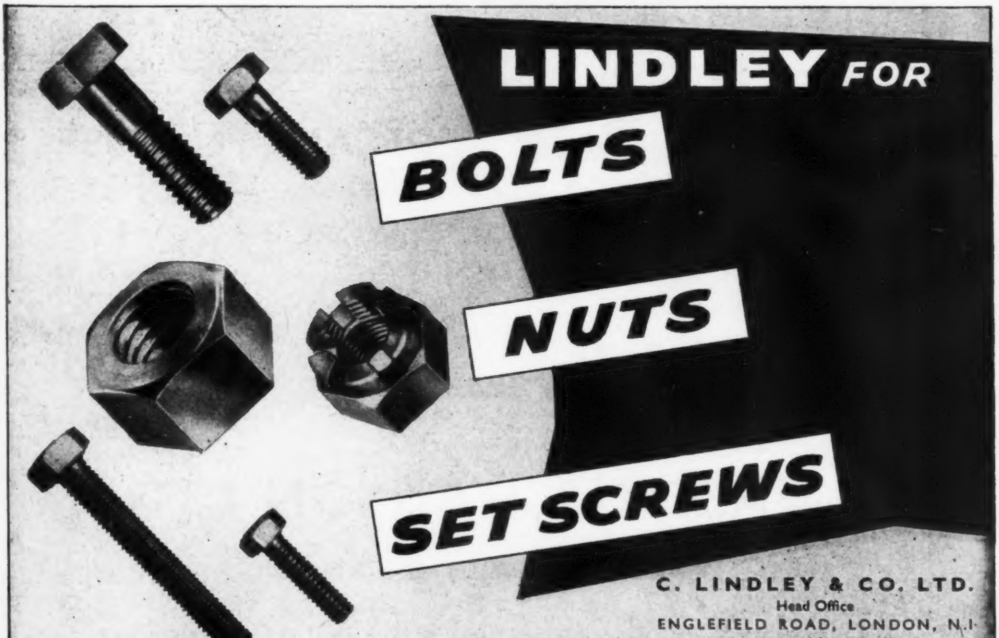
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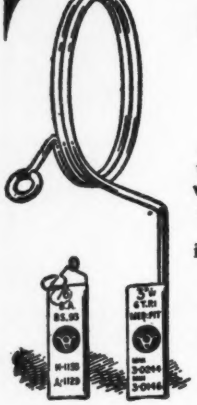

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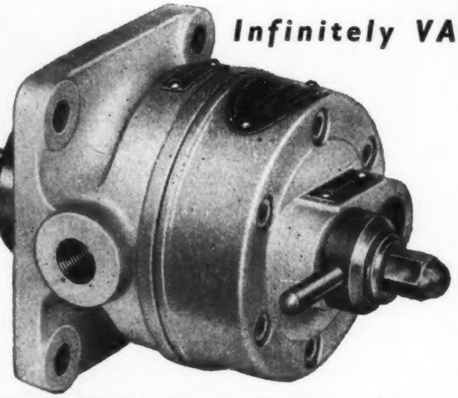

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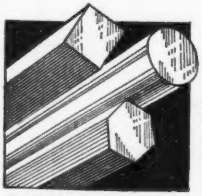

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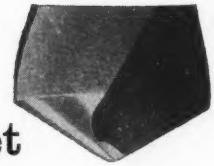

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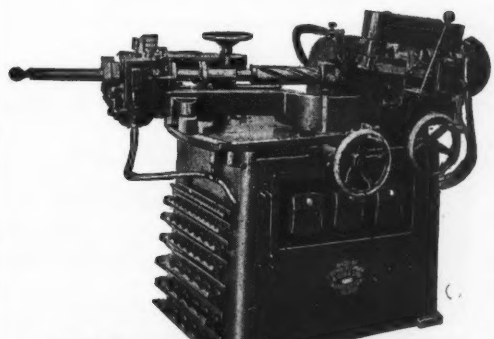

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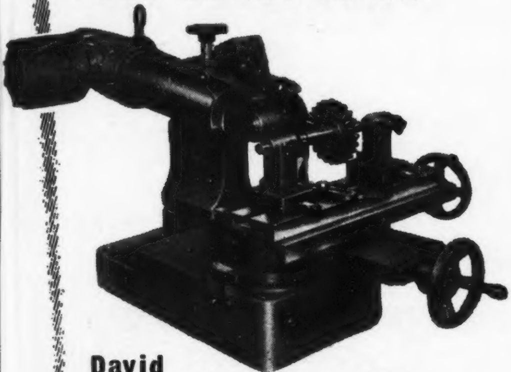

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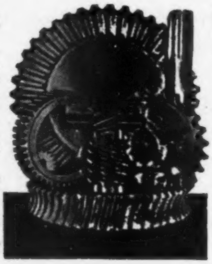

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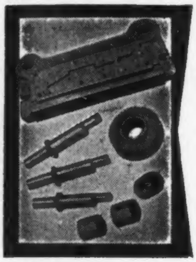

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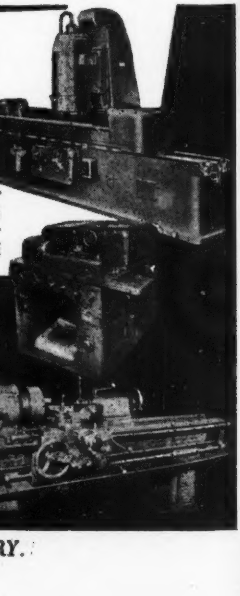

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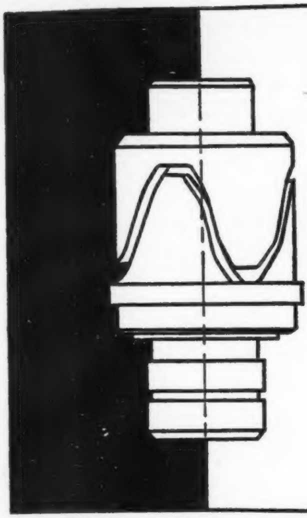

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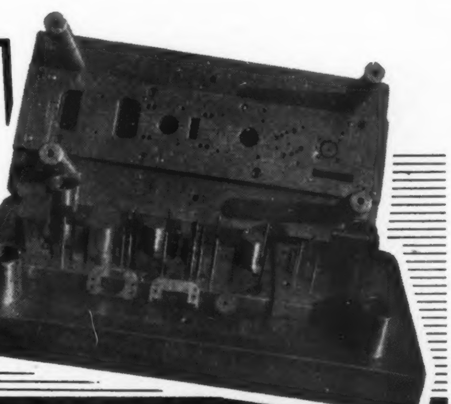

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No. 2 **WARNER & SWASEY** Capstan Lathe. Chucking.
43in. × 12in. **FRITZ WERNER** Vertical Miller. Swivelling head.
20in. **ARCHDALE** Plain Miller. Power feeds and rapids. Spindle speeds 60-1,230 r.p.m.
20in. **ARCHDALE** Plain Miller. Power feeds and rapids. Spindle speeds 30-615 r.p.m.
No. 3 **KITCHEN & WADE** Honer.
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11in./16in. **NOBLE & LUND** Hydraulic Cold saw with Hydraulic clamp.
Model HBY **CHURCHILL** Electrical Grinder.
14in. **BUTLER** Slotter. Power revolving table.
No. 3 **RICHARDS** Horizontal Borer Model PRT3.
No. 3 **KEARNS** Horizontal Borer.
No. 2 **KEARNS** Horizontal Borer.
16in. **CRAVEN** Lathe, 20ft. between centres.
54in. × 15in. **CRAVEN** Universal Milling Machine.
HERBERT S.E. Capstan Lathe.
4A **LIBBY** Turret Lathe.
CRAVEN Worm Milling Machines.

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LONDON, W.12
SHEpherds Bush 4401/2

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By Robertson

FOR SALE

At present set up with 7 pairs of rollers for forming angle sections 2¼in. x 2¼in. Roll shafts 2¼in. dia. centres adjustable up to 7¼in.

Weight about 6 tons.

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VICTORIA WORKS, LONDON, N.W.10
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Bryant No. 24-36 Hydraulic Internal Grinder, complete with Hydraulic Wheel Dressing device, Spindle, etc.
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LANG 15in. S.S. & S.C. Gap Bed Lathe, geared head, 60in. between centres.

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CONOMATIC 1¼in. 8-spindle Type W.W.

BORERS

RICHARDS Horizontal Borer 2A, with facing head.
JUNGENTHAL Vertical Borer. Chuck diameter 39in., maximum swing 46½in.

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ASQUITH 4ft. O.D.1 Radial Drill.
PROGRESS 5E Round Table.
ARCHDALE 28in. Heavy Duty Pillar Drill

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MODEL 61 **FELLOWS** Gear Shaper. Straight spur 35in. dia. × 5in. face width.

LATHES

WARNER & SWASEY No. 2A Long Bed.
SOUTHBEND 16in.
EDGWICK 7in.
DEAN, SMITH & GRACE. Height of centres 7in.
MONARCH 22M S.S. Taper Turning Lathe.
WARD 10 Combination Turret Lathe.
WARD 2A.
WARD 3A. with Ball Chuck and Bar Feed.
HERBERT 4 with Flamard bed, draw back chuck and Bar Feed.

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28in. **ARCHDALE**, Rapid all ways.
18in. **EDGWICK** Production Mill.
CINCINNATI No. 5 High Power Plain Hor. 1942 Machine.
CINCINNATI No 4 Vertical High speed, power down.
CINCINNATI No 3 Vertical medium speed, power down.
MILWAUKEE 2H Vertical—rebuilt.
MILWAUKEE 2HL Vertical—rebuilt.
MILWAUKEE 2K Plain—overhauled.
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PEGARD Bed Type Vertical, table 84in. × 29in.—slightly used.

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Selections of Machine Tools from Stock or Early Delivery

DRILLING MACHINES

New **KITCHEN WALKER** 6ft. E. 3 Radial Drilling Machine, No. 5 M.T. spindle.
ASQUITH LDR 4ft. 6in. Radial Drilling Machine, No. 4 MT spindle.
KITCHEN & WADE 6ft. Girder Type Radial Drilling Machine, 18 spindle speeds, 6 feeds, No. 5 M.T. spindle.

BORING MACHINES

WEBSTER & BENNETT Series D 36in. Single Column Type Vertical Boring Mill.

SLOTTING MACHINES

ORMEROD 12in. stroke Slotting Machine, 27in. dia. rotary table.

LATHES

COLCHESTER 8½in. Mascot S.S. & S.C. Gap Bed Lathes, to admit 6ft. 6in. between centres.
CRAVEN 15in. S.S. & S.C. Lathe, to admit 10ft. between centres.
DEAN, SMITH & GRACE Surfacing and Boring Lathe, with hexagon turret, swing over bed 24in., swing in gap 36in.
LANG 12½in. Gap Bed S.S. & S.C. Lathe, to admit 10ft. 6in. between centres.
CRAVEN 15in. S.S. & S.C. Lathe, to admit 25ft. between centres. Two Saddles.

MILLING MACHINES

MILWAUKEE Model 2K Heavy Duty Dial Type Vertical Milling Machine, working surface of table 56in. × 12in.
ST. ANDRE Horizontal type Havy Duty Plain Milling Machine, table size 73in. × 16½in.
VICTORIA V.3 Vertical Milling Machine, swivel head, power feeds and rapid traverses to table in all directions, working surface of table 60in. × 12½in.
C.V.A. "Kearney & Trecker" model 2E Dia. Type Horizontal Plain Milling Machine, working surface of table 41in. × 12in., longitudinal feed 29in., cross feed 12in., 8 spindle speeds 25/1,000 r.p.m.
CINCINNATI Model 3/36 Hydromatic Milling Machine, table 54in. × 14in.

BROACHING MACHINE

CINCINNATI 10 ton Vert. Single Ram Hydraulic Surface Broaching Machine, 66in. stroke, 20in. × 20in. table.

GRINDING MACHINES

JONES & SHIPMAN Fig. 540 18in. × 6in. Hydraulic Horizontal Spindle Surface Grinding Machine, with 14in. × 6in. magnetic chuck.
JONES & SHIPMAN 8in. × 16in. Tool and Cutter Grinding Machine.
CHURCHILL 16in. × 36in. Model PBH Universal Grinding Machine, with hydraulic feed and internal grinding attachment.

PLANING MACHINE

STIRK 10ft. × 4ft. 6in. × 4ft. 6in. "Hiloplow" Double Column Planing Machine, with four toolboxes, Stirk Split Field Motor Drive.

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HORDERN MASON & EDWARDS Model L.70 Power Press, 70 tons capacity, adjustable stroke ⅞in. to 4$\frac{1}{16}$in., table 30in. × 26in.
One New **PEARSON** 75 ton Hydraulic Press Brake, 9ft. × ¼in. capacity.
New **BUTTERLEY** No. 4, 20 Ton Ungeared Power Press, 1in.-3in. adjustable stroke.

SAWING MACHINES

NOBLE & LUND 40/48in. Cold Circular Sawing Machine, 17in. diameter rounds, 15½in. squares, 27in. × 12in. seams.
NOBLE & LUND 24in./28in. Cold Circular Sawing Machine, 10in. dia. rounds, 9in. squares, 18in. × 7in. seams.

SCREWING MACHINES

KENDALL & GENT 3-2 Tangential Head Screwing Machine, to screw bolts up to 2in. outside diameter, tubes up to 3in. inside diameter, machine fitted with leadscrew.

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All the above machines are motorised 400-440/3/50 cycles.

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New Process 100 kV Seam Welder, 400/3/50.
British Federal 50 kVA Flash Butt Welding Machine. 400/3/50.
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100 Ton Fielding ditto 10in. ram, 72in. stroke, 99in. daylight.
50 Ton Fielding ditto, 3ft. stroke.
Bliss 70 Ton Geared Double Sided Power Press. 400/3/50 supply.
3 Bliss No. 304 Vertical Single Action Drawing Presses, 7½in. stroke, 50 tons. American.
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8ft. × ⅜in. Bennie Bending Rolls.
7ft. × 1in. Craig Donald Flattening Rolls.
"Pyramid" Bending Rolls, 9ft. 0in. × ⅜in.
200 Tons Tangye Hydraulic Straightening Press, bed 25ft. × 3ft., stroke 21in., motorised travelling table, 2 ram pump.
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Pels Punch Shears and Cropper, 12in. blade, shear ⅝in. takes 6in. × 6in. × ⅝in. angles.
Robertson Shears, ⅜in. capacity, 10 h.p. 28in. blade, 9in. maximum opening. (Two.)
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New 1-cwt. and 2-cwt. Hammers by Massey and Alldays & Onions, also 3-5-cwt. secondhand E.O.T. Cranes.
30 Ton Marshall Fleming, 29ft. span, cab control.
25 Ton Clyde, 21ft. 9in. span, cab control 1954. Can convert any span to 95ft.
20 Ton Vaughan 42ft. 3in. span. Unused.
20 Ton Morris Goliath, 35ft. span, 5 ton auxiliary.
10 Ton Heywood, 34ft. span. Unused.
10 Ton Morris, 32ft. 10in. span, cab control
10 Ton, 60ft. span. 1955. (Two.)
5 Ton, 37ft. span. 1944.
3 Ton Morris, 149ft. span. 1954.

FRED WATKINS (ENGINEERING), LTD., Coleford, Glos. 'Phone: Coleford 2271 (5 lines).

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Corona Heavy Duty Vertical Drilling Machine. No. 5 Morse Taper. Excellent condition.
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LELAND GIFFORD 3-spindle Drilling Machine, mounted on 4-spindle base. Spindles No. 3 M.T.
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JONES & SHIPMAN 4-spindle Drilling Machine, No. 2 Morse Taper.
HERBERT Type C Pedestal Drilling Machine, No. 3 Morse Taper, 230 volts, single phase. Auto spindle feed, flange mounted motor.

ENGRAVING MACHINES

TAYLOR, TAYLOR & HOBSON Model D Engraving Machines. (New.)
TAYLOR, TAYLOR & HOBSON Model A Bench Engraving Machine. (New.)
DECKEL Engraving Machine.

FILING AND SAWING MACHINES

CRYPTO Horizontal Bandsawing Machine.
WELLS Horizontal Bandsawing Machine, 16in. × 5in. capacity.
GROB Model A3 Band Filing Machine, table 25in. × 17in.
RAPIDOR Motorised Filing and Sawing Machine, Table 15in. × 15in.

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CHURCHILL-CLEVELAND Rigidhobber, 6in. dia. × 9in. face, 3 d.p.
BARBER COLMAN 12in. Gear Hobber.
FELLOWS No. 645A3 Gear Shaper, 18in. × 3in.

GENERAL LATHES

CHURCHILL REDMAN 11MN Lathe, 11in. centre, 36in. swing in gap, 5ft. b.c.; 3⅝in. hollow spindle.
BETTS-BRIDGEFORD 30in. swing × 22ft. Lathes, 16ft. between centres.
OLDFIELD & SCHOFIELD 21in. centre × 15ft. Gap Bed Lathe, 6ft. between centres 4½in. hollow spindle, 62in. swing in gap.
SOUTHBEND 7½in. × 5ft. Lathe, 2ft. between centres.
DEAN, SMITH & GRACE 6½in. centre 13Z Lathe.
LANG JUNIOR 6½in. × 6ft. Lathe, 30in. between centres.
LANG 24in. Surfacing and Boring Lathe.
LE BLOND 10in. Rapid Production Lathe. 7ft. between centres.
CROMWELL 3½in. × 40in. Lathe, stepless speeds to 2,000 r.p.m.
SMART & BROWN 4½in. Sabel Lathe.

GRINDING MACHINES

DELAPENA Model 301 Cabinet Stand Honing Machines. Capacity 0.120in. to 3.125in., with assortment of wedges, adaptors, mandrels and stones
MATRIX No. 1A Universal Grinder, 8in. × 24in.
CHURCHILL 16in. × 50in. Universal Tool and Cutter Grinder.
CHURCHILL 12in. × 36in. Hydraulic Universal Grinding Machine, with internal spindle.
BROWN & SHARPE 12in. × 30in. Universal Grinding Machine.
CHURCHILL 18in. × 6in. Model O Universal Tool and Cutter Grinding Machine.
CHURCHILL 8in. × 16in. Model O Semi-Universal Grinding Machine.
BILLETER twin head Radial Arm Open Sided Hydraulic Slideway Grinder. Table 9ft. 8in., × 2ft. 3in., infinitely variable table speeds 6ft. 6in. to 38ft. per min., push button control, rapid traverses, telescopic bed covers.
CHURCHILL 24in. × 6in. Horizontal Spindle Surface Grinding Machine.
SUPERIOR Horizontal Surface Grinder, 15in. × 5in., hand feed. (New.)
BROWN & SHARPE 18in. × 6in. Horizontal Surface Grinding Machine.
COVEL 24in. × 8in. Hydraulic Horizontal Surface Grinder.
JUNG 18in. × 6in. Hydraulic Horizontal Surface Grinder.
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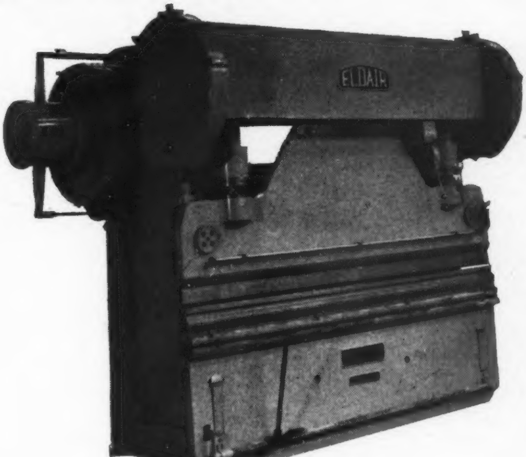

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BROWN & SHARPE '00' Automatic.
HERBERT 4BS Capstan.
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HERBERT 4 Spindle Drill.
CORONA 2 Spindle Drill.
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MYFORD M.G.9 Uni. Grinder.
ESSEX Centreless Grinder.
ABWOOD Surface Grinder. Vert. Sp.
BROWN & SHARPE No. 11 Grinder.
LEBLOND No. 15 R.P. Lathe.
HOGARTH S.S. Lathe.
D.S. & G. 13Z Lathe.
HERBERT ND Lathe.
SOUTHBEND 10in. Lathe.
ADCOCK & SHIPLEY No. 3 Hor. Mill.
MILWAUKEE Simplex 12/24 Mill.
CINCINNATI Model 08 Vertical Mill.
MILWAUKEE 4H Uni. Mill.
MILWAUKEE 2HL Hor. Mill.
CLEVELAND Vertical Mill.
ARCHDALE 18in. Vertical Mill.
REED PRENTICE 3VG Vert. Mill.
KELLER 1210 Diesinking Machine.
KITCHEN & WADE No. 2 Honing Machine.
SENTINEL 25T Power Press.
ORMEROD 4in. Slotter.

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GLEASON 3in. Str. Bevel Gear Generator.
GLEASON 12in. Str. Bevel Gear Generator.
FELLOWS 7125 High Speed Gear Shaper.
FELLOWS No. 7 High Speed Gear Shaper.
FELLOWS 61A High Speed Gear Shaper.
HEALD 72A3 Internal Grinder.
GLEASON No. 16 Spiral Bevel Hypoid Gear Generator.

All machines motorised 400/3/50 unless otherwise stated.

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Newman

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BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle

BORING MACHINES

KEARNS Model OB Horizontal Boring and Facing Machine, 2¼in. diameter travelling spindle (1957).
UNION Model BFT100 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle (1955).
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.

CAPSTAN AND CENTRE LATHES

CHURCHILL-REDMAN Model 13NM Heavy-Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. Swing in gap 50in.
MITCHELL Model DM10 S.S. & S.C. Gap Bed Centre Lathe, 10½in. centre height × 7ft. 5in. between centres. (NEW.)
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
NILES Heavy Duty Centre Lathe, S.S. & S.C., 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

CRAVEN Roll Grinding Machine, capacity 20in. swing × 138in. between centres.
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

MISCELLANEOUS

LANGE & GAILEN 28in. stroke Double Headed Hydraulic Shaping Machine
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

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Machine Tool Division: YATE, BRISTOL

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S.V

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COLCHESTER "Triumph" 7in. Gap Bed Centre Lathe.
SOUTHBEND 16in. swing, 6ft. 6in. between.

AUTOMATIC AND CAPSTAN LATHES

DRUMMOND Model K Chucker.
PETERMAN Model HS10.

MILLING MACHINES

VICTORIA Model M1, Hori. Mill.
ARCHDALE Hori. Mill, 38in. × 10in. table.
T.T.H. 3 Dimensional Pantograph Milling and Diesinking Machine.

GRINDING MACHINES

KAESER Hydraulic Surface Grinder, cap. 24in. × 8in., with mag. chuck, etc.
CHURCHILL No. 1 Planetary Cylinder Grinder.
CHURCHILL 6in. × 20in. Hydraulic Plain Cylindrical Grinder.

PRESSES

HUMPHRIS 80 ton open fronted inclinable, adjustable stroke.
New **RATZER** 12 ton Power Press, adj. str.
SWEENEY & BLOCKSIDGE No. 6 Detachable Arm Flypress.

MISCELLANEOUS

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RHODES 6ft. 6in. × ¼in. Heavy Duty Universal Swing Beam Folder.
OSTER Screwing Machine, 2in. gas max.
RICHARDS Horizontal Borer, non-travelling spindle, 32in. facing head, with extension to face about 5ft. dia.

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Mitchell 8½in. S.S. & S.C. Gap Bed A.G.H. Lathe with 3in. Hollow Spindle. Speed range 30-400 r.p.m. Further details from:

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MIKRON 122 UNIVERSAL GEAR HOBBER

(Capacity 1¼in. Diam.)
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RICHARDS 48in. Vertical Borer.
ASQUITH Portable Radial Drill.
CHURCHILL Hcy Internal Grinder.
STANLEY 8½in. × 48in. S.S. & S.C. Lathe.
ARCHDALE 20in. Horizontal Miller.
CINCINNATI 4/36 Hydromatic Miller.
PRATT & WHITNEY Thread Miller, 4½in. × 12in.

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H.M.V. Horizontal Borer, Type A.V.75, 3in. Travel Spindle.
TERRY Super 8 Bench Drill.
PACERA Bench and Pillar Drill, ½in., TRU.
SPEEDAX Abrasive Cutting off Machine.
CARDIFF 11in. × 80in. S.S. & S.C. Lathe.
MITCHELL (HALIFAX) 8½in. × 4ft. 6in. S.S. & S.C. Lathe.
DENBIGH No. 6 Fly Press.
RAPIDOR 6in. Saw.

TOOLS FOR SALE EX-SITE

BUFFALO 28U Double Ended Punch, Shear and Angle Cropper.
ASQUITH 6ft. Radial Drill with screw-cutting attachment.
LANG 26in. Boring and Facing Lathe.

MACHINES MOTORISED 400/3/50 UNLESS OTHERWISE STATED

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TURNER 14/20 20in. × 3½in. wheels C/E.
NEWALL 420 Univ. Threads.
HUNT No. 0 and 1 Tap Regrinders.
HUNT No. 0, 2 and 3 Drill.
CHURCHILL Valve.
HONER
DELAPENA 4-speed.
KEYSEATERS
BENTLEY 5in.
ASQUITH H.K.O. Horiz. Duplex.
EDGWICK 4in.
LATHES
DEAN, SMITH & GRACE 7in. S.S. & S.C.
CHURCHILL Cub, 6in. × 24in. S.S. & S.C.
SOUTHBEND 13in. S.S. & S.C.
DENHAM 4½in. × 24in. S.S. & S.C.
LE BLOND Production, 11in.
RIVETT S.S. & S.C. 4in. Model 602.
SOUTHBEND 10in. Toolroom.
WILLSON 7½in. × 36in. S.S. & S.C.
MONARCH 10EE × 22in. S.S. & S.C.
SMALLPIECE 9SW Multi-tool.
RIVETT 3½in. Plain. Model 715.
WARD, HAGGAS & SMITH 8½in. × 78in.
RYDERMATIC No. 12 Multi Tool.
BERRY 6½in. × 36in. S.S.& S.C.
MISCELLANEOUS MACHINES
LUKE & SPENCER 38in. × 4 HP Polisher.
CANNING 54in. × 2 HP Polisher.
Dust Extractors, Various.
MILLERS (Horizontal)
DENBIGH C4. Table 46 × 10.
CINCINNATI O8 Production.
CINCINNATI 1/18 Production.
ROSCHER EICHLER. Table 39in. × 12 in.
ST. ANDREA Model UFO3 Table 57 × 14.
KENT OWEN 1/8 Production.
HARDINGE Precision. Table 25 × 6½.
WERNER. Table 14 × 5.
JONES 225 Univ. Table 22 × 6.
ARCHDALE 20in. dial and 14in. mfg.
RICHMOND O3. Table 40 × 10.
U.S. Multi Mill.... Production.
MILLERS (Vertical)
REED PRENTICE No. 2.
BROWN & SHARPE No. 2 Light.
C.V.A. 79 Tool and Die.
REED PRENTICE No. 5, 68in. × 16in. table.
WADKIN Type LXIA. Table 36in. × 13in.
PRESSES (Power)
BESCO BA 20. Adj. Str.
BLISS No. 18. Adj. Str.
BLISS No. 16 Bar.
LECRA No. 8. 4 tons.
WRIGHT Clicking Press.
PROFILING MACHINE
CURDNUBE 2 Spindle. Model KIV.
RIVETERS
HIGH SPEED Hammer, 7/16 cap.
TURNER RH18 (⅛in.), RH38 (⅜in.), RH34 (¾in.), RH14 and 14/12 (½in.).
SCREWING MACHINE
ATLAS No. 2, 3in.-6in. (Unused.)
SHAPERS
INVICTA 10in.
NEWEY 14in.
SHEET METAL MACHINES
BESCO 12in. and 16in. Treadle Guillotines.
FROST 6in. × ⅛in. Power Guillotine.
BESCO 21in. × 1½in. Rolls.
BESCO 48in. Power Guillotine.
SLOTTERS
EDGWICK.
TAPPERS
ESSEX No. 24, ½in. cap.
ACE Horiz., ½in. cap.
J. & S. Electrotap, ½in.
THREAD MILLERS
WICKMAN MOULTON 1B.

Kitchen & Wade H5 Horizontal Boring and Drilling Machine, complete with Square Box Table and Auxiliary Revolving Table. Machine equal to new.
Further details from —
C. & G. OLDFIELD, LTD.,
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No. 9A Herbert M/D All-gd. Combination Turret Lathe. Covered vee bed. Swings 20½in. dia. over bed. Roller bearing spindle bored 4½in. dia. Admits 60in. spindle to turret. 16 spindle speeds 21-809 r.p.m.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

Randalls (LUTON) LIMITED
Selbourne Road Luton Tel. 52351

New Machines From Stock

BEAVER Model A Turret Mill.
EAGLE 18in. by 6in. Surface Grinder.
ELLIOTT TV2 Turret Mill.
INVICTA 4M Shaper.
PROGRESS 3A 1½in. capacity Pillar Drill.
WOODHOUSE Mitchell 369 Turret Mill.
HARRISON 13/ Swing S.S./S.C. Lathe.
MYFORD MG.12 Grinder.
ARBOGA 27in. Radial Drill. 1in. capacity.
RAGLAN 5in. S.S./S.C. Lathe.

FORREST

RHODES 6ft. 0in. × ¼in. Guillotine.
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LANG 22in. Boring and Facing Lathe.
ORMEROD 36in. Shaper.
REDMAN 10ft. × 4ft. × 3ft. Planer, Lancs. drive.
RICHARDS No. 1 and 2 Horiz. Borers.
DENHAM 11in. × 6ft. 6in. S.S. & S.C. Lathe.

W. FORREST & CO. LTD.,
SYLVESTER GARDENS,
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'Phone: 23314/5.

Churchill HBB Internal Grinder with Sizematic Attachment.
Further details from:—
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Clifton & Baird 48in. Circular Saw Sharpener. 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

Classified Advertisements *(PLANT FOR SALE, contd.)*

MIDLAND

BENDING ROLLS

RHODES 6ft. × 14 gauge Power Bending Rolls.

CROPPING MACHINES

Double Ended Angle Cropping Machine. Capacity up to 6in. × ⅝in. angles.

DRILLING MACHINES

POLLARD 13in. Pillar Drill, No. 2 Morse Taper, R. & F. table 11in. × 11in.
AMERICAN 6ft. Heavy Duty Radial Drill. No. 6 M.T. Older machine, good condition. 400/3/50 sep. motor.

FOLDING MACHINES

EDWARDS 6ft. × ⅛in. High Lift Swing Beam Universal Folder.

GRINDING MACHINES

New **N.I.** 10in., 12in., 14in., 16in. and 20in. D/E Tool Grinders.
ABRASIVE No. 34 24in. × 8in. Vertical Spindle Surface Grinder.

GUILLOTINES

RUSHWORTH 4ft. × ¼in. Overcrank Guillotine. Little used.

KEYSEAT] HINES

EDGWICK Keyseater. Stroke 4½in. Table 26in. × 9in.

LATHES

HERBERT No. 4 Capstan. 2⅛in. H/Spindle. Speeds to 511.

MILLING MACHINES

EDGWICK No. 2 Horizontal Miller. Table 46in. × 11in.
MILWAUKEE 3H Vertical Milling Machine

NIBBLERS

BURFREE 2A Nibbling Machine. Capacity ⅛in. M/S.
W.F. 14 gauge Nibbler. 59in. throat.

PRESSES

TAYLOR & CHALLEN 370 20-ton O/F Press.
TAYLOR & CHALLEN 845 Dial Feed Notching Press. Capacity 6 tons.
TAYLOR & CHALLEN 1455 Dial Feed Notching Press. Capacity 2 tons.
BRADLEY & TURTON No. 3 Flypress.
SWEENEY & BLOCKSIDGE Bench Press. Capacity 3 tons.

SAWING MACHINES

BARSON No. 1 Saw. 1¾in. rounds, 2in. tubes, 1⅝in. × ⅜in. flats, 1⅝in. × ¼in. angles.

SCREWING MACHINES

KENDALL & GENT 3in. Screwing Machine. Leadscrew type.

SHAPING MACHINES

TOWN 26in. Heavy Duty Shaper.

POLISHING MACHINES

3 and 5 h.p. Double Ended Polishing Spindles.

WELDING EQUIPMENT

PRESCOTT 15 kVA Spot Welder.

CRANES

BROADBENT 40 Ton O.E.T. Crane. 10 tons auxiliary lift.

All machines 400/3/50 electrics unless otherwise stated.

THE
MIDLAND MACHINE TOOL CO.
BRADLEY, BILSTON, STAFFS.
Tel.: Bilston 42471/9

FRYE

POYLE ROAD, COLNBROOK
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CHURCHILL 18in. by 72in. Plain Grinder. **£975.**
LANDIS 12in. by 48in. Universal Grinder with internal Spindle. **£975.**
COVENTRY Matrix 21 Thread Grinder. **£650.**
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CAPSTANS—LATHES—AUTOS

WARD 2A Capstan. Bar and Chuck Machine. **£585.**
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HILLE 1¼in. Capstan speeds to 1,200, feeds to turret and cross slide. hob and drag screwcutting. **£685.**
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WARD O.E. Capstan. **£385.**
SOUTHBEND 6½in. Centre Lathe. **£275.**

SHEET METAL MACHINERY

150 ton 10ft. by 3/16in. Press Brake with Fraser Mono Radial. 30 H.P. pumping unit. **£2,750.**

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Two **STEINEL** Model SH4D Horizontal Milling Machines. 30in. by 8in. Table. **£500 ea.**
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RICHMOND MV1 Vertical Miller, table 30in. by 10in. Speeds to 1,000. **£285.**
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ADCOCK & SHIPLEY Vertical Mill. Table 13in. by 5in. Speeds 150-3,000 (Excellent). **£325.**

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WEBSTER & BENNETT 36in. Hi-power Vertical Borer. **£975.**
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FRYE MACHINE TOOL COMPANY LTD.
Telephone: Colnbrook 2442/3/4
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Open Saturday Mornings

Asquith type H.D.P. two-spindle Profile Milling M/c. Adjustable cross-rail. Ind. motor drive to each spindle. Capacity 24in. × 28in. Spindle speeds 250-3,000 r.p.m.—LEE & HUNT LTD., Crocus Street, Nottingham. 'Phone 84246.

Cincinnati No. 2 M.H. Plain Horizontal Milling Machine, W.S.O.T.. 7in. × 44in.
Further details from —
C. & G. OLDFIELD, LTD.,
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Taylor & Challen No. GDP3½ Double Sided Geared Double Action Cam Drawing Press. Punch stroke 10in. Blankholder stroke 5½in. Between side frames 22in. Size of punch 5in. dia. Size of blankholder 12in. dia. Arranged motor drive 400-440/3/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

No. 9 Herbert Turret Lathe. Complete with starter, motor built in, bearings and slideways, overhauled. £400.—ENFIELD TOOL MANUFACTURING CO., LTD., Alma Road, Ponders End, Middlesex. Telephone: Howard 2774.

Peterman 10-HS Sliding Head Automatic, ⅜in. cap., 5-slide, combination and self-opening diehead atts., equipment, collets, bushes, holders, etc. Recent model.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

Micromatic "Hydrohoner" Hydraulic Honer. Model H1. Auto cycle. Table 11½in. × 10in. W/S. Ind. motors. —WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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Tel. Coventry 25418 and 26221.

USED AND RECONDITIONED MACHINE TOOLS AT BARGAIN PRICES

SCRIVEN H/D 8ft. × ¼in. Plate Guillotine. Price £3,250
PALLAS Universal Miller, U2, 40in. × 10in., all geared, power traverse all round. Price £350
SAGAR (New) Wood Turning Lathes, full equipment. (**HALF NEW PRICE.**) Price £200
CINCINNATI No. 4, Plain power feeds, dial type, spindle speeds 18/1,300 r.p.m. Price £1,750
HERBERT 2-Spindle, All geared head on 3-spindle pedestal base, table 36in. × 15in. fitted No. 3 quick change chucks. Spindle speeds 104-562. Price £200
RHODES Press Brake, 8ft. × ⅛in., Motorised, undercranked. Price £750
RHODES Guillotine, 8ft. × ¼in., motorised. Price £750
RHODES Press Brake, 4ft. × ⅛in., single pulley drive. Price £250
RHODES Press Brake, 10ft. × ¼in., undercranked, motorised. Price £500
RHODES Press Brake, 4ft. × ⅛in., single pulley. Price £135
BESCO 75-ton D/Sided Inclinable, 4½in. stroke, motorised, fitted with Udal guards, platen 27in. × 27in. Price £575
CINCINNATI No. 4 Vertical Miller, 1,300 r.p.m. Price £2,300
CINCINNATI 1/18 Manufacturing Miller, 1,500 r.p.m., with backlash eliminator. Price £675
MILWAUKEE No. 4 Horizontal, 1,000 r.p.m. Price £1,475
CINCINNATI Plain Grinder, 10in. × 36in., Model "ER" (As New), Late 1957. Price £1,550
REED PRENTICE Toolroom Lathe, 10in. centres × 78in. between centres. Price £800
ARCHDALE 20in. Horizontal Miller, dial type feeds and speeds, 615 r.p.m. Price £395
DEAN, SMITH & GRACE 6½in. Centre Lathes, taper turning, full equipment. Price £575 each
TOWN Radial Drilling and Tapping Machine, 6ft. arm rise and fall, tee slotted, low base, No. 5 Morse taper. Price £675
RICHMOND 0.3 Plain Miller. Price £300
STANLEY 11in. Heavy Duty Lathe. Price £1,250
STANLEY 7in. Centre Lathe. Price £525
ARCHDALE Column Drill, compound table, No. 5 Morse. Price £575
COVELL Hydraulic Surface Grinder, 24in. × 8in. Price £775
2 off **GLEASON** Spiral Gear Roughing and Finishing Gear Cutters, 12in. (excellent condition). Price £250
SMART & BROWN Toolroom Lathe, 4in. × 18in. b.c. Full equipment, collets and attachment. Price £200
3 off—**WARD** No. 7 Capstan Lathes, covered bed, power feeds turret, saddle and cross slide, complete equipment, four-way toolpost, rear toolpost, arranged for chucking, 1,000 r.p.m., in excellent condition. Price £850 each
MILWAUKEE "2HL" Vertical Miller, swivel head, table 46in. × 9in., dial feeds and speeds, 16 spindle speeds 35-1,088, rapid traverse, pump, tank and fittings. Price £850
2 off—**BROWN & SHARPE** No. 13 Universal Tool and Cutter Grinders, complete with equipment. Price £425 each
BRYANT No. 5 Internal Grinding Machine. Price £175

THESE MACHINES CAN BE INSPECTED AT ANY NORMAL BUSINESS HOURS AT OUR STOKE-ON-TRENT BRANCH

Kitchen & Wade G.5 6ft. Girder Radial, 3 Feeds and 3 Speeds. Machine No. 13642. Further details from:
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Member of B.A.M.T.M.

NEW MACHINES FOR IMMEDIATE DELIVERY

VOLMAN Gear Shapers and Hobbing Machine. Capacity 7⅞in.—49in. dia.

WEYDEMANN & HASSELKUS Cutter Grinding Machine. Max. cutter dia. 16in.

TOS FEK 80 Cam Miller for peripheral, face and cylindrical cams by mechanical copying from templates.

FAVRETTO Model RTB2000 Heavy Duty Hydraulic Surface Grinding Machine. Table 79in. by 16in. Table traverse 84in. Cross traverse of grinding head 17in.

OPUS 120 Metal Filing and Sawing Machine. Table 11in. by 11in. Max. thickness of workpiece 2⅜in.

ELGAR MACHINE TOOL CO. LTD.
172-178 VICTORIA ROAD, ACTON, LONDON, W.3
Telephone: ACOrn 5555 (7 lines)

Cincinnati No. 3 Dial Type Horizontal Milling Machine complete with Universal Dividing Heads and Circular Table. Excellent condition.
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SOAG

SPECIAL PRICE—
IF YOU ACT NOW!

KITCHEN & WADE Type H3 Horizontal Boring and Milling Machine. Year of manufacture 1953.
In new condition.
Spindle diameter 3½in.
Speed range (36) 8.5-800 r.p.m.
Main motor 7½ h.p.
Complete with motorised 72in. diameter Rotary Table.

Due to reorganisation this late type Borer has become available and is offered, for a short period only at a special "ex-situ" price.
Inspection by appointment

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– BETTER TRY 600 FIRST !

DEAN, SMITH & GRACE 15in. All Geared Head S.S. & S.C. *STRAIGHT BED CENTRE LATHE.* Admits 17ft. between centres. Hollow spindle bored 3¼in. dia. 16 spindle speeds 3.19 to 343 r.p.m. Motor drive 400-440/3/50. Price: £1,250

PARKSON Model 2T *UNIVERSAL MILLING MACHINE.* Table size 45in. × 10in. Spindle speeds 15 to 360 r.p.m. Complete with vertical milling attachment, slotting attachment and power operated rotary table. Motor drive 400/3/50. Price: £625

HOBROUGH 6in. × 18in. Horizontal Spindle *SURFACE GRINDING MACHINE.* Hand feeds to table and rise and fall wheelhead. Wheel size 8in. × ½in. × 1¼in. bore. With magnetic chuck. Motor drive 400-440/3/50 Price: £425

CHURCHILL REDMAN 24in. Stroke *CRANK SHAPING MACHINE.* 8 speeds 9 to 117 strokes per min. Working surface of compound table 22in. × 16in. × 16in. Motor drive 400-440/3/50. Price: £875

KELLENBERGER Model 51 *UNIVERSAL GRINDING MACHINE.* 9in. swing × 36in. between centres. Mechanical table traverse. 4-speed workhead. With internal spindle. Motor drive 400/3/50. Price: £775

RICHARDS Model PRT No. 2 Horizontal *BORING, FACING AND MILLING MACHINE.* 3in. dia. traversing spindle, bored No. 5 Morse Taper. 21in. dia. facing head. 32 spindle speeds 3.5 to 300 r.p.m. Main table 48in. × 30in. Auxiliary table 36in. × 36in. Max. distance facing head to boring stay 6ft. 3in. Motor drive 400/3/50. Price: £3,950

SNOW Model P24 8in. × 24in. Horizontal Spindle *SURFACE GRINDING MACHINE.* Hydraulic feed to table traverse. 4 speeds to wheelhead 1,775 to 2,840 r.p.m. With magnetic chuck. Motor drive 400/3/50. Price: £625

NOBLE & LUND Model No. 1 Heavy Duty *METAL CUTTING BANDSAWING MACHINE.* Tee slotted work table 72in. × 54in. Max. throat distance 48in. Max. depth of work admitted under guides 30in. Cutting speed 168ft. per min. Power feed to table. Motor drive 400-440/3/50. Price: £1,150

MILLER & CROWNINGSHIELD Horizontal *MILLING MACHINE.* Working surface of table 17¼in. × 4in. Hand lever feed to longitudinal traverse. Hand screw feed to cross and vertical traverses. 12 spindle speeds 150 to 2,665 r.p.m. Motor drive 400-440/3/50. Price: £175

ALEXANDER Three Dimensional *ENGRAVING AND DIE-SINKING MACHINE.* Pantograph ratio 1.5 : 1 to 10 : 1. Working area of copy table 17½in. × 12½in. Working surface of work table 13¼in. × 8in. 6 speeds to cutter spindle. Motor drive 400/3/50. Price: £325

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AUTOMATICS

MANURHIN Type PD12A Automatic with Hopper feeds for parting off and chamfering Cartridge Case heads. 5 machines. (These nearly new machines may be adapted for other work and are offered at the lowest price.)
RYDERMATIC No. 18 Vertical Automatics 60 H.P.

BORING MACHINES

MATHEYS Model FPN/28 Semi Jig Borer. (1956.)
PADDON Mk. 3 type WP Cylinder Re-Boring Machines.

HONING AND LAPPING

WOLTERS Model I.L.I. Hydraulic Internal Lapping Machine.
DELAPENA Honing Machine.

CAPSTANS AND TURRET LATHES

BOLEY-LEINEN Model ER 15 ¾in. Capstan (Modern) (1953).
HERBERT No. 2 Pre-optive Bar Turret Lathe. Flamard bed, 2in. capacity with bar feed, full turret tooling.
HERBERT Model 22A Turret Lathe. 8½in. Spindle Hole.
LIBBY 2H 8in. spindle Turret Lathe.

CENTRE LATHES

Two **WILLSON** 7¼in. Newel Lathes.
SOUTHBEND 7in. Centre Lathe.
CRAVEN Heavy Duty Railway Wheel Lathe, swing 6ft. by 12ft., vee belt drive. Weight 25 tons.
New **CAPITOL** 9¼in. Centre Lathe admitting 6ft. between centres.
FACEPLATE Lathe, 9ft. swing.

GRINDING MACHINES

OLIVETTI Model R 4-500 plain cylindrical grinder (1953).
MOPCO Model RUP 108YW. Combination horizontal and vertical spindle toolroom hydraulic Surface Grinder, table 38in. by 11in. (1953).
ZENITH Model PH Horizontal Spindle Hydraulic, Surface Grinder, 24in. by 8in. (1953).
VICO (Swiss) Hydraulic Toolroom Universal Grinder 10in. by 30in. (1953).

CRAVEN Heavy Duty Roll Grinding machine with capacity for rolls 42in. dia. by 12ft. between centres and fitted with automatic cambering. Will take rolls up to 25 tons weight. Fully motorised machine of modern design. Weight 25 tons.

GRINDING MACHINES

WALDRICH SIEGEN Roll Grinder. 36in. by 13ft. between centres.
LOTH Universal Grinder (new).
Two **CINCINNATI** No. 2 Tool and Cutter Grinding Machines.
COVEL No. 2 Tool and Cutter Grinding Machine.
IMPERIA Tool and Cutter Grinder, Model M6 AR. (1953).
MATRIX No. 16G Plain Straight Thread Grinder.
SCRIVENER No. 1 Centreless Grinder.
BLAKE No. 1 Tap Chamfering Machine (New).
MATRIX No. 6 Internal Thread Grinders 3in. by 10in.
HEALD Model 81 Sizematic Internal Grinder.
PETEWE Model 3D Profile Grinding Machine (Nearly New).

DIESINKING MACHINES

VICTORIA Duplomatic Hydraulic Copy Milling Machine, 8in. by 8in. (New).

DRILLING MACHINES

ASQUITH Model ODI Radial Drilling Machine 4 M.T.
PACERA ½in. Bench Drill (New).
Two **ARCHDALE** 36in. Radial Drilling Machines. No. 4 M.T.
Various **ACIERA** Precision Bench Drills.

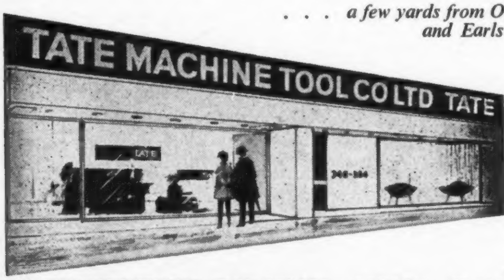
GUILLOTINES

BESCO 42in. by 10 s.w.g. Power Guillotine.
HANDS 4ft. by ¼in. Guillotine.
RHODES 6ft. by ¼in. Guillotine.

MILLING MACHINES

MILWAUKEE Model 5H Vertical Mill, dial type, high speed model with power down feed to head, table 94in. by 18in. (New price U.S. $36,680. This machine is in beautiful condition, offered at a fraction of replacement cost.)
FRITZWERNER Model 8101 Automatic Miller (1953).
EDGWICK No. 1 Horizontal Milling Machine 40in. by 10in. table.
DENBIGH Model No. C4 Horizontal Milling Machine.
SANT ANDREA Model U.F.O/5 Heavy Duty Horizontal Miller. 86¼in. by 19in. Table travel 67in. (1953).

. . . a few yards from Olympia and Earls Court



348-354 KENSINGTON HIGH STREET - LONDON - W. 14
WEStern 7031 (5 lines)

TATE

VICTORIA Junior Omnimil (New).
Two **ARCHDALE** 18in. Automatic Cycle Kneeless Production Millers.
VICTORIA Model V2 Vertical Mill (1956).
SOMUA Model FH2C Horizontal Miller, table 67in. by 14¼in. (1953).
CUNLIFFE & CROOM No. 2 Vertical Mill (dial).
FACKS Thread Miller.
ARCHDALE 34in. Plain Horizontal Miller (nearly new).
BEAVER Model VRBP Vertical Miller (New).

PLANING MACHINES

STIRK 16ft. by 5ft. double column Planers, four toolboxes; modern machines with Lancashire drive (Two).
HOLROYD Plano Mill 17ft. 6in. by 9ft. 6in.

POWER PRESSES

RHODES 1-Ton Open Fronted Bench Press with flange motor and UDAL guards.
LEE & CRABTREE 15-ton Horning Press.
LEE & CRABTREE 20-Ton Horning Press.
LEE & CRABTREE 35-Ton Double Action Mechanical Press.
RHODES 150-Ton Double Sided, Geared, Adjustable Stroke Power Press (1956).
H.M.E. Model DCP3 70-ton Double Sided, Double Crank, Single Action Power Press.
Three New **MULLER** Model AMP 22-ton Power Presses.
Three New **MULLER** Model AMP 35-ton Power Presses.
Two New **MULLER** AMP 45-ton Power Presses.
Two New **MULLER** AMP 60-ton Power Presses. Open Fronted.
Two New **MULLER** AMP 80-ton Power Presses.

SHAPING MACHINES

BERRY 16in. Shaper.
BROOK 18in. Shaping Machine.
KLOPP 22in. Shaping Machine.
TORPEX 22in. Shaping Machine.
New **LIMA** 22in. Shaper.

SAWING AND FILING MACHINES

WESPA AS4 Bandsawing and Bandfiling Machine, hydraulic feed (similar Do-all V/16).

WATCHMAKERS' MACHINES

MIKRON No. 79 Gear Hobber (almost new).
SAFAG Model 24 Cutter Relieving Machines.
LAMBERT Model 66 Gear Hobber.

Classified Advertisements (*PLANT FOR SALE, contd.*)

DOUGLAS
OF HIGH WYCOMBE

NEW MACHINE TOOLS FOR IMMEDIATE DELIVERY FROM OUR SHOWROOM

MILLING MACHINES

VICTORIA Juniormil Plain Horiz. Mill.
VICTORIA V2 Vertical Mill.
VICTORIA U2 Rapidmil Universal Mill.
VICTORIA V3 Vertical Mill.
VARNAMO FU2 Universal Mill.

LATHES

STANLEY 8½in. × 6ft. b.c. S.S. & S.C. Lathe.

GRINDING MACHINES

JAKOBSSEN SJ16 32in. × 12in. Hydr. Surface Grinder.
RIBON RUR1000 10in. × 40in. Universal Grinder.
EXCEL No. 1 Pedestal Swing Head Grinder.

SHAPING MACHINES

ALBA 4S 18in. Stroke Shaper.
INVICTA 6M 24in. Stroke Shaper, with auto down feed.
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WICKSTEED 8in. Hydramatic Hacksaw.
MANCHESTER Rapidor 6in. Medium Duty Hacksaw.
MANCHESTER Rapidor 6in. Light Duty Hacksaw.
QUALTERS & SMITH 6in. Heavy Duty Hacksaw.
STARTRITE Sabre Bandsaw.
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Complete range of ½in. and ¾in. Bench and Pillar Drills by **FOBCO, PROGRESS, PACERA** and **KERRY.**
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MATRIX No. 10 Thread Grinder.
VICTORIA V2 Vertical Milling Machine.
DENBIGH C4 Horizontal Milling Machine.
BEAVER Model A Vertical Turret Milling Machine.
SWEENEY & BLOCKSIDGE No. 12 50T Power Press.
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CINCINNATI 1–18 Production Miller.
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EDGWICK Horizontal Mill, 11in. by 46in., 24–405 r.p.m.
BROWN & SHARPE No. 2 Horizontal Mill.
CINCINNATI Manufacturing Miller, 18in.
MAMMUT Horizhand Lever Mill, 10in. by 24in.
KENDALL & GENT Vert. Mill., 19in. by 69in.
TRIDENT Vertical Mill, 8in. by 30in., 75–750 r.p.m.
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WARD 3A Ball Chuck Bar Feed.
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WARNER & SWASEY No. 2 Capstan.
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HOLBROOK 8in. by 36in. Lathe, 11–400 r.p.m.
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This Division of the Company is utilising the latest light current techniques in the control of variables and constant speed drives and the application of contactless switching devices to industrial control schemes. These posts offer an excellent opportunity to gain experience in these new fields, and provide an interesting and progressive career in Sales Engineering.

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David Brown Industries Limited, Machine Tool Division, Ashburton Road, Trafford Park, wish to appoint a sales estimator. The position requires sound practical knowledge of machine and component estimating for sales quotations. An attractive salary will be offered to experienced applicants.

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Chief Inspector, A.I.D., A.R.B. Approved. 18 years experience production tools, planning, estimating. General machine shop technique. Also rubber manufacture and hose assemblies M.O.S.—BOX D161, MACHINERY Clifton House, Euston Road, N.W.1.

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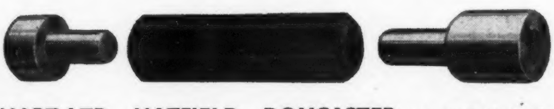

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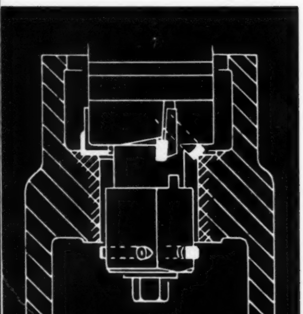

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